INTERFACE AGE

MICROCOMPUTING FOR HOME AND SMALL BUSINESS VOLUME 2, ISSUE 10, SEPTEMBER 1977 $1.75
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Microcomputers: Intelligent Terminals

Star-Ship Simulation - Part II

Depreciation Analysis Program

INTERFACE AGE
MAGAZINE
Presents
THE FLOPPY ROM
PROGRAM SHEET
33 1/3 RPM
MONAURAL
Side 1

SWTPC announces first dual minifloppy kit under $1,000

Now SWTPC offers complete best-buy computer system with $995 dual minifloppy, $500 video terminal/monitor, $395 4K computer.

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$500 Terminal/Monitor
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The SWTPC 6800 comes complete with 4K memory, serial interface, power supply, chassis, famous Motorola MIKBUG® mini-operating system in read-only memory (ROM), and the most complete documentation with any computer kit. Our growing software library includes 4K and 8K BASIC (cassettes $4.95 and $9.95; paper tape $10.00 and $20.00). Extra memory, $100/4K or $250/8K.

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The professional-grade microcomputer for professionals

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CROMEMCO HAS THE SOFTWARE

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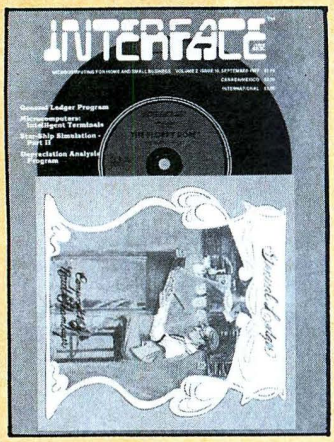

COVER STORY

In this month's cover our artist Merrilyn Joyce salutes a hundred years of bookkeeping represented by the Dickensesque figure at his high desk with sleeve protectors and green eyeshade and Bud Shamburger with his micro-bookmaker, the Altair™ 8800B and its floppy disc peripherals.

Last year so much was heard about the scientific milestones on our nation's 200-year journey. Most of them make us famous; some make us notorious, and many have added to our everyday convenience in a quiet manner. The development in the mechanics of accountancy are one such milestone. Double entry bookkeeping has been with us since the Renaissance in Italy. Since then the tedium of the work has never seriously been questioned when weighed against the advantages to both citizen and State. Now much of the tedium is relegated to the computer and the advantages of evaluating wealth remain for the owner and his taxman. You've come a long way, Cratchit!

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INTERFACE AGE™

MICROCOMPUTING FOR HOME AND THE SMALL BUSINESSMAN

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Up your organization.

The Basic Box (left) and the Peripheral Plate.

With no-nonsense organizers from the Digital Group.

Not so long ago, the microcomputer domain belonged to a special group of creative, inventive folks — the inveterate hardware hackers who delighted in making a thing work and didn't really care all that much about how it looked.

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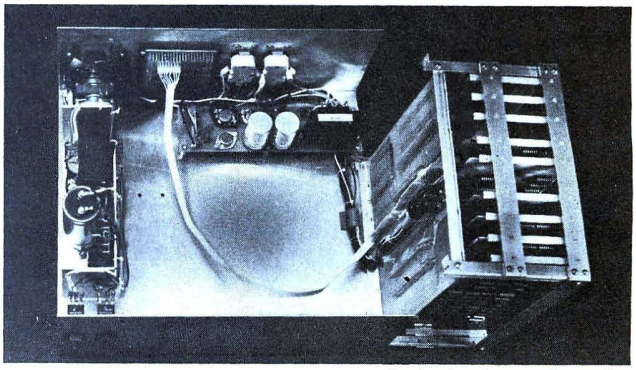
The Peripheral Plate is a piece of bent metal with room for your keyboard, video monitor, two Phidecks or an audio cassette recorder. All at your fingertips. For organization.



Card rack swings out for service.

Naturally, our basics have down-to-earth prices, too. The Peripheral Plate is a mere $19.50 . . . the basic Basic Box goes for $45 (a little more depending on options).

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INTERFACIAL

Last month's issue represented Linda's, Michael's and Merrilyn's special efforts. This month the tour-de-force was performed by Bob Jones, Bob Stevens and Bud Shamburger who have been working for months in the preparation of this software Floppy ROM #2 issue.

The first of the Shamburger series, GENERAL PAYROLL PACKAGE appeared in the June issue of INTERFACE AGE. In this issue we are presenting the second package which will be published in three parts on three consecutive months.

Another feature of milestone significance is Jeb and Elizabeth Long's report on MICROCOMPUTERS: THE INTELLIGENT TERMINALS. This article describes the long-overdue application of interface between an Altair 8800 and a remote timeshare installation. This method allows the user to prepare programs at leisure on the inexpensive home system and use the timeshare facility as a mass storage device.

Roger Garrett continues with Part II of his STAR-SHIP SIMULATION. His emphasis on the advisability of structured programming cannot be repeated too often. The hobbyist is in the enviable position: he begins his computing activities from Point Alpha and if in the course of his learning experience he has acquired good programming habits, they will stay with him for a lifetime. Roger points out that a little discipline at the beginning averts untold grief later.

The same is true for English. Teachers who encourage their students to "express themselves" first and later attempt to teach them the craft of writing with its canons of grammar, syntax, punctuation and structure, discover that they have developed garrulous anarchists whose output will be scarcely usable in either the arts or the sciences. That principle holds true for literature, mathematics and programming.

Energy consciousness is the *Zeitgeist* of the '70s. This consciousness in computer technology has three aspects, cost-saving, safety and noise abatement. Roger Edelson in his Card-of-the-Month report describes how to control A.C. power output safely and avoid adding noise to your computer. Also in the Hardware Section a duet of applications of PerSci products are described by Michael Busch and Dan Gaines in AN ADVANCED DISC-BASED SYSTEM and followed by Bob Stevens' account of the PERSCI INTELLIGENT FLOPPY DISC CONTROLLER.

As you have noticed in the August issue, we have added two new columns. The topics about which the columnists write offer many useful guidelines to money-making activities in the expanding world of computers. Whether you are a professional programmer or a gifted amateur, at some point the desire to market your services on your own may develop. The logistics of marketing — protecting yourself, selling and fulfilling the requirements of taxation will need to be learned. In the beginning your confusion will be so monumental that you'll be unsure which question to ask to solve your problems.

Elliott MacLennon, Stephan Murtha and Merl Miller offer not so much solutions to your potential problems, but advice on asking the right question. Once the problem is defined, the solution is usually simple to obtain.

As we can all instinctively feel there are many more good livelihoods to make within the field of computer technology and the people best prepared to ask the right questions first will be the first to obtain the right answers and the first to enjoy success.

—L.F.-S.

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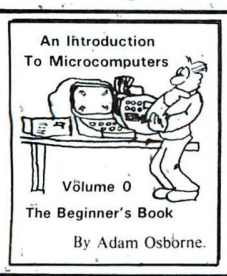

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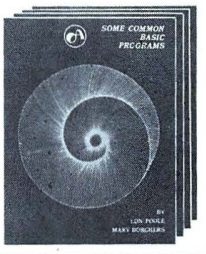

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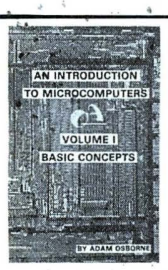

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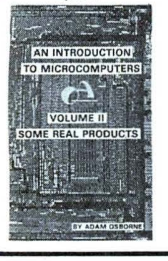

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(212) 686-7923

The Computer Corner
200 Hamilton Ave.
White Plains, NY 10601
(914) 949-3282

OHIO

Cybershop
1451 S. Hamilton Rd.
Columbus, OH 43227
(614) 239-8081

Computer Mart of Dayton
2665 S. Dixie Ave.
Dayton, OH 45409
(513) 296-1248

OREGON

Byte Shop Computer Store
3482 SW Cedar Hills Blvd.
Beaverton, OR 97005
(503) 644-2686

The Real Oregon
Computer Co.
205 West 10th Ave.
Eugene, OR 97401
(503) 484-1040

Byte Shop Computer Store
2033 SW 4th Ave.
Portland, OR 97201
(503) 223-3496

RHODE ISLAND

Computer Power, Inc.
M24 Airport Mall
1800 Post Rd.
Warwick, RI 02886
(401) 738-4477

SOUTH CAROLINA

Byte Shop
2018 Green Street
Columbia, SC 29205
(803) 771-7824

TENNESSEE

Microproducts & Systems
2307 E. Center St.
Kingsport, TN 37664
(615) 245-8081

TEXAS

Byte Shop
3211 Fondren
Houston, TX 77063
(713) 977-0664

Interactive Computers
7646½ Dashwood Rd.
Houston, TX 77036
(713) 772-5257

The Micro Store
634 So. Central
Expressway
Richardson, TX 75080
(214) 231-1096

VIRGINIA

The Computer Systems
Store
1984 Chain Bridge Rd.
McLean, VA 22101
(703) 821-8333

Media Reactions Inc.
11303 South Shore Dr.
Reston, VA 22090
(703) 471-9330

WASHINGTON

Byte Shop Computer Store
14701 N.E. 20th Ave.
Bellevue, WA 98007
(206) 746-0651

The Retail Computer Store
410 N.E. 72nd
Seattle, WA 98115
(206) 524-4101

WISCONSIN

Madison Computer Store
1910 Monroe St.
Madison, WI 53711
(608) 255-5552

The Milwaukee
Computer Store
6916 W. North Ave.
Milwaukee, WI 53213
(414) 259-9140

CANADA

Trintronics
160 Elgin St.
Place Bell Canada
Ottawa, Ontario K2P 2C4
(613) 236-7767

First Canadian
Computer Store Ltd.
44 Eglinton Ave. West
Toronto, Ontario M4R 1A1
(416) 482-8080

The Computer Place
186 Queen St. West
Toronto, Ontario M5V 1Z1
(416) 598-0262

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4509-11 Rupert St.
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Processor Technology Corporation

LETTERS TO THE EDITOR

Dear Editor:

A Hewlett-Packard 9825A Desktop Computer is missing as of July 13 from a locked laboratory in the Department of Electrical Engineering at Michigan Technological University and is presumed to be stolen. The computer has 15,036 bytes of read/write memory (Option 001) and front plug-in memories for String-Advanced Programming, Matrix, and 9862A Plotter-General I/O-Extended I/O. Also missing with the 9825A computer is a Hewlett-Packard 9862A Plotter and a Hewlett-Packard 1722A Oscilloscope.

A reward is being offered for information leading to the arrest and conviction of the person or persons who stole this equipment. Anyone having information concerning the missing equipment is asked to write to me. All information will be held in strict confidence.

Richard F. Schwartz
Professor and Head
Michigan Technological University
Houghton, Michigan 49931

Dear Editor:

Here's some feedback about INTERFACE AGE Magazine.

Adam Osborne's column is great. He is a compliment to your magazine, and if I had my way I'd ask him for a larger piece for the magazine. I can't say enough for it. His column alone makes your whole magazine worthwhile.

Recently Mr. Osborne related in his column that National Semiconductor keyboard kits are being used by hobbyists to interface their personal computers. How about doing an article on interfacing that keyboard kit for the benefit of the rest of us? If you do so, please give information on interfacing with both the S-100 bus and the SWTPC 6800 SS-50 bus. That way, more hobbyists would benefit.

The "Calendar" is a good feature. The clubs help the industry and the clubs need all the help they can get. I'm waiting to see how Bill Sevedge's "Sense Line" column turns out.

Could you make a small change in your advertiser's index? Start a new category called "Software Houses." "Manufacturers" doesn't really describe the software vendors.

Articles like "Qube" and "Remotoid" don't particularly appeal to me. I would like to see imaginative ideas discussed, but I feel these "Remotoid" and "Robots As Household Pets" type articles should be much shorter, more to the point, and the extra space used for discussion of more of these ideas.

Articles such as "Proposed Data Storage Format Standard" by Mr. Mohler should be sought. Heaven (and every MPU user) only knows how desperately standards are needed. Uniform cassette storage standards would also bring a big benefit to INTERFACE AGE. "Floppy ROM" use would be made much easier as a bonus.

Speaking of the "Floppy ROM," INTERFACE AGE Magazine has scooped the competition. I hope that you support other CPUs besides the 8080 and 6800. Software for the Z-80 and 6500 is also needed. Plus, how about software for less popular MPUs such as F-8 and SC/MP on occasion, also.

A note for Mr. Osborne: How about a confirmation or denial of the Z-200 (Zilog) stack processor that Jim Warren hinted about in the Silicon Gulch Gazette? Where is Zilog going from here anyway?

Thank you very much for providing a good magazine at a sensible price. I hope that I will have cause to renew my subscription each year — year after year.

Michael Iddings

You did not include your address in your letter, and the envelope got lost, so we have to reply in this manner. Your letter contained such an abundance of good ideas which we have read, discussed and filed. Thanks. It is unfortunate that space forced us to chop up your missive, especially since it was all so complimentary. You'll have, however, the satisfaction of seeing some of your good ideas take form in the future.
—Editor

Dear Editor:

I have read three issues of your magazine and loved each one. And so, like a drug addict, would like more. So please send me any back issues you can find lying around and bill me. What I really like about your magazine is the concentration of articles toward software, instead of hardware such as BYTE does. KEEP UP THE GREAT WORK.

T.L.

We intend to keep up this policy.
—Editor

Dear Editor:

Your magazine surpasses the other microcomputer/hobbyist magazines by a large margin. I appreciate your detailed articles on both hardware and software. Keep up the good work.

Joe Maloney

Watch for our specials, too!
—Editor

Dear Editor:

Your article regarding the Computrac 2000 record player system in your May 1977 issue reveals an interesting application of the Intel 8080 microprocessor. Frequently accompanied with such marvelous innovation in design are tradeoffs in other areas, such as mechanical reliability. For the benefit of your readers, could you provide the address of the manufacturer (Cheeseboro Products Corp.) so that mechanical and electronic specifications and a cost figure can be obtained for this system and also systems described in future issues?

Otto R. Fischer
Texas Instruments
M/S 269, 13500 Central Expressway
Dallas, TX 75222

We published the author's address

in our July issue. Here it is again. Cheeseboro Products Corporation, 11633 S. Alameda St., Los Angeles, CA 90059. (213) 776-3435 or (213) 678-3683. —*Editor*

Dear Editor:

I'm really not writing this letter directly to you but rather I'm appealing to my fellow hobbyists. I have noticed many letters from Brooklynites. This doesn't surprise me since population-wise Brooklyn is the fourth largest city in the United States. To my dismay, however, I am not aware of any club in Brooklyn. I know that we have a computer club based in New York City, but none representing Brooklyn itself.

I'm sure there are many hobbyists in Brooklyn, and I think we should be represented. I think writing this letter is the first step. So to all you fellow Brooklynite hobbyists, drop me a line and let's get together.

John P. Wasack
1438 83rd St.
Brooklyn, N.Y. 11228

The writer also also wanted some pointers on how to start a club. How about giving the chap some help. INTERFACE AGE would appreciate it. —*Editor*

Dear Editor:

Your magazine is excellent! Keep up the work — I can hardly wait for the September issue! (Please try to include a MITS cassette version on the Floppy ROM.)

I would like, however, to take issue with Chris Terry's statement in your July issue in that selectrics are not reliable. On the contrary — they are extremely reliable with very little maintenance involved. The biggest enemies of the selectric are liquid paper particles and eraser crumbs. Since microcomputer systems use neither of these, a user should experience very few problems.

If you are having problems with your selectric, the chances are you have either a poor repairman and the mechanism needs proper adjustment, or your interface is poorly designed with improper timing.

Good repairmen for high speed typing are hard to find. Once the mechanism is adjusted for such typing, however, this minimizes later problems. Our repairman is an ex-IBM repairman who is used to MTST's and memory typewriters, yet charges only half the IBM rates. Check with local businesses using MTST's or memory typewriters. Try to locate a reliable repairman. A good repairman (on his own) will have few qualms about modifications to the basic mechanism. He has already seen most variations of the machine. Do not expect the company that sold you the rebuilt machine to have it optimally adjusted. Even if under warranty, the best alternative would be to locate a good local repairman. Most major cities have a few. Proper adjustment will also minimize wear on the mechanism. An occasional light oil spray is the only preventive maintenance needed — something the user can do himself.

The interface should not be a modified version of the original electronics. We tried a modified board for a year and then designed our own from scratch. The original board would lock the keyboard, flash error lights occasionally, pick up noise, and otherwise give us *conniptions.* We designed our own with only a few criteria:

1. It should be simple. (Simple things work more reliably.)
2. It should require no system software modifications.
3. It should be very reliable.

Our new board is now extremely reliable. The typewriter using it has been running for about three months under heavy use (we are word-processing our third book now) with NO down time or repair either mechanically or electrically. There have been no lock-ups, wrong characters, or other problems. (Incidentally — we do sell this interface board.)

Another note of caution — we advise using the Dura machines as a 1041 or 1021 with the solenoids integral to the mechanism in preference to the popular modified selectric office typewriter with actuator-type solenoid assembly. The Duras seem to work much better mechanically. We had one Dura machine running continuously at the San Francisco Faire with one mistake the whole weekend. We complained to our repairman on our return, only to find the machine was really a new machine and had been assembled minus one part. He installed the part, and we have experienced no problems with it since then.

Carl Townsend
Director
Center for the Study of the Future
4110 NE Alameda
Portland, Oregon 97212

The purpose of publishing INTERFACE AGE is to present all points of view. It was unfortunate that Chris Terry's byline was left out at the head of his article — apologies to him and to our readers. The opinions voiced in that article are the author's and do not imply an endorsement by this magazine. —*Editor*

Dear Editor:

Do you know of any "BASIC" written for the RCA Cosmac 1802 computer? I have a homebrew 1802 that I am presently adding more memory to and a CRT terminal with ASCII keyboard. I assume that RCA would have high level languages, but from looking at the price of their software available with their development kits, they would be out of my price range. Please let me know if you can help or not. Thanks.

Gregory T. Harris
5334 Oak
Kansas City, MO 64112

Readers, do you have any information to offer Mr. Harris? —*Editor*

Announcing the West Coast's largest Personal Computing Show. April 28, 29, and 30, 1978 at California's brand new Long Beach Convention Center. This is a selling show with 180 booths (each draped, carpeted and with 500 watts of electricity). Three full days of conference sessions. There will be home brew exhibits, exhibitors lounge, inquiry badge system, computerized registration, a newsroom, and a full blown advertising and promotional campaign to bring you thousands of qualified buyers.

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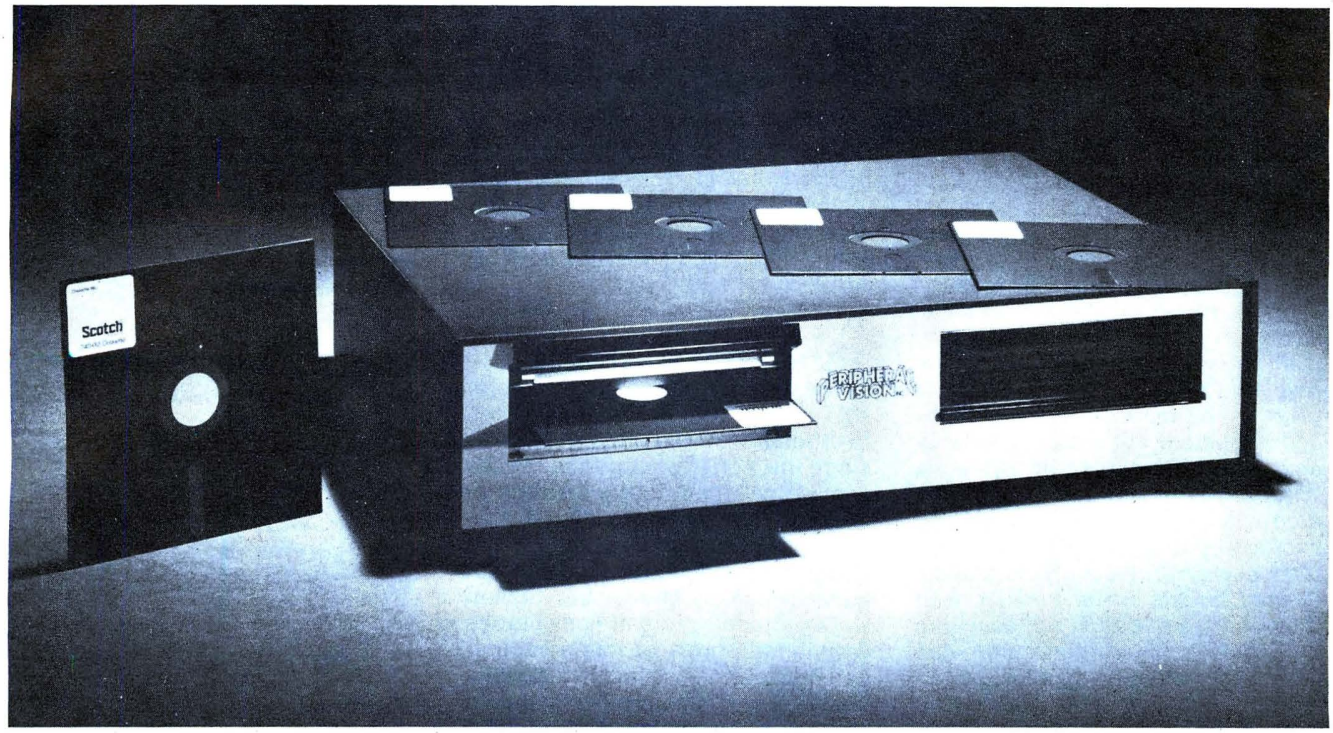

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We think you'll flip over our first product.

It's a full-size floppy disk for the Altair-Imsai plug-in compatible S-100 BUS. And it's available for as low as $750.

Here are the features:

- 1 interface card supports 4 drives
- Stores over 300,000 bytes per floppy
- Bootstrap EPROM included—no more toggling or paper tape
- Completely S-100 plug-in compatible
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- Drive is from Innovex (the originator of the floppy concept)—assembled and tested
- Interface card design is licensed from Dr. Kenneth Welles and the Digital Group
- Disk operating system with file management system included on floppy
- Cabinet and power supply optional

Prices:	Kit	Assm.
Interface card kit and assembled and tested drive	$750	$850
Power supply—+24V at 2A	45	65
Cabinet—Optima, blue	—	85

Now, a little more about our company.

Peripheral Vision may be brand-new, but we have some old-fashioned ideas about how to run our business.

We know there are serious incompatibilities among the different manufacturers' peripherals and CPU's. We want to get them together. And, we want to bring significant new products to market—products consisting of everything from adaptation instructions/kits for hardware and software to major new products.

It's a tall order, but we feel we're up to the task. Peripheral Vision has already obtained a license from The Digital Group to adapt versions of some of their products to the S-100 BUS. And we're working on getting more from other companies.

Most important to our customers, Peripheral Vision is committed to helping you get along with your computer. We'll do all we can to make it easy.

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City/State/Zip_____

UPDATE

CLASS IN HARDWARE ANALYSIS AND DEBUGGING PERSONAL COMPUTER SYSTEMS

The classes run for six weeks, Wednesday evenings from 7-9 p.m. Reason was that many personal computer users who did not have digital design background were asking for support. We do offer such support. However, these users can save time and money once they learn their way around the hardware. Also, the many personal computer users have realized many service operations are not really knowledgable about their specific systems. With all the manufacturers pouring products into the personal and microcomputer market, these systems could only be analyzed and debugged by the users familiar with their configurations. It will be a long time before one organization can have all the answers to all the problems created by manufacturers. The fee is $50.00. For further information contact Tech-Mart, 19590 Ventura Blvd., Tarzana, CA 91356.

NEW COMPUTER STORE

THE BIT BUCKET is to be opened on the Campus of Ball State University to provide Muncie, Indiana with the only personal computer store within a 70-mile radius. Target opening date is September 19, 1977. For further information contact Richard F. Ramsey, R.R.2 Box 273, Hartford City, IN 47348, or call (317) 348-4386.

NEW CLUB

A user group has been formed for people interested in the Commodore PET 2001 Computer.

The PET is a compact computer with integrated keyboard, a CRT with character and graphics capability, cassette drive, 14K ROM Operating System including full 8K BASIC, and 4K RAM user space. The PET will provide exceptional computing value with a complete price of $595.

The purpose of the PET User Group will be to share and exchange applications, programs, and hardware expansion techniques, and to provide general user feedback.

The first year membership is $5.00 and will include the User Notes publication.

Interested? Contact Gene Beals, PET User Group, P.O. Box 371, Montgomeryville, PA 18936.

HOUSTON PERSONAL COMPUTING FAIRE

The Houston Personal Computing Faire will be held at the Shamrock Hilton Hotel in Houston, TX, September 17-18, 1977. For information regarding booth rental and registration, contact Matt Barkley at (713) 667-9535.

HOBBYIST'S NETWORK

The PCNET (Personal Computer NETwork) Committee has been functioning in the Palo Alto area since the April Computer Faire. The committee's goal is the creation of regional (followed by national) personal computer networks for the computer-to-computer transfer of messages and files. A set of network protocols (sets of conventions defining all levels of intercomputer communication) is almost completely designed. These protocols should be operable in 8K bytes of machine code, and are designed to be implemented in string BASIC.

The committee believes this should be attractive to personal computer users. Participation will be voluntary; you can decide to participate on any given day of network operation. Network functioning will be relatively insensitive to the absence of an appreciable fraction of member computers.

Our current thinking indicates the following tentative equipment required for participation in the network: a personal computer with 12-16K of RAM and string BASIC; an originate/answer MODEM capable of 300 BPS. A message service — the ability to send a message (generally in English text, although almost any file can be sent) is quite valuable.

The PCNET Committee is about to start a series of experiments. We would welcome people with personal computer systems who would like to participate; we're especially interested in people in the Palo Alto dialing area. We would also be most interested in similar network efforts in other places. We'd like to avoid west coast chauvinism and want to work closely with people in other parts of the country. For further information write or call: Dave Caulkins, 437 Mundel Way, Los Altos, CA 94022, (415) 328-2411 (work) or (415) 948-5753 (home).

TI Distributors

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ARIZONA: Phoenix, Kierulff Electronics (602) 243-4101; R. V. Weatherford (602) 272-7144; **Tempe,** G. S. Marshall (602) 968-6181.

CALIFORNIA: Anaheim, R. V. Weatherford (714) 633-9633; **Canoga Park,** G. S. Marshall (213) 999-5001; **El Monte,** G. S. Marshall (213) 686-0141; **El Segundo,** TI Supply (213) 973-2571; **Glendale,** R. V. Weatherford (213) 849-3451; **Goleta,** RPS, Inc. (805) 964-6823; **Irvine,** Cramer/Los Angeles (714) 979-3000, (213) 771-8300; G. S. Marshall (714) 556-6400; **Los Angeles,** Kierulff Electronics (213) 685-5511; RPS, Inc. (213) 748-1271; **Mountain View,** Time Electronics (408) 965-8000; **Palo Alto,** Kierulff Electronics (415) 968-6292; **Pomona,** R. V. Weatherford (714) 623-1261; **San Diego,** Cramer/San Diego (714) 565-1881; Kierulff Electronics (714) 278-2112; G. S. Marshall (714) 278-6350; RPS Inc. (714) 292-5611; R. V. Weatherford (714) 278-7400; **Sunnyvale,** Cramer/San Francisco (408) 739-3011; G. S. Marshall (408) 732-1100; TI Supply (408) 732-5555; **Torrance,** Time Electronics (213) 320-0880; **Woodland Hills,** JACO (213) 884-4560.

COLORADO: Denver, Cramer/Denver (303) 758-2100; Kierulff Electronics (303) 371-6500; **Englewood,** R. V. Weatherford (303) 761-5432.

CONNECTICUT: Hamden, Arrow Electronics (203) 248-3801; **North Haven,** Cramer/Connecticut (203) 239-5641; **Orange,** Milgray/Connecticut (203) 795-0714.

FLORIDA: Clearwater, Diplomat/Southland (813) 443-4514; **Ft. Lauderdale,** Arrow Electronics (305) 776-7790; Hall-Mark/Miami (305) 971-9280; **Hollywood,** Cramer/Hollywood (305) 923-8181; **Orlando,** Cramer/Orlando (305) 894-1511; Hall-Mark/Orlando (305) 855-4020; **Winter Park,** Milgray Electronics (305) 647-5747.

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INDIANA: Ft. Wayne, Ft. Wayne Electronics (219) 423-3422; **Indianapolis,** Graham Electronics (317) 634-8202.

IOWA: Cedar Rapids, Decco (319) 365-7551.

KANSAS: Shawnee Mission, Hall-Mark/Kansas City (913) 888-4747.

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NORTH CAROLINA: Raleigh, Hall-Mark/Raleigh (919) 832-4465; **Winston-Salem,** Cramer/Winston-Salem (919) 725-8711.

OHIO: Cleveland, Arrow Electronics (216) 464-2000; Cramer/Cleveland (216) 248-8400; **Columbus,** Hall-Mark/Ohio (614) 846-1882; **Dayton,** ESCO Electronics (513) 226-1133; **Kettering,** Arrow Electronics (513) 253-9176.

OKLAHOMA: Tulsa, Hall-Mark/Tulsa (918) 835-8458; TI Supply (918) 582-8272.

PENNSYLVANIA: Huntingdon Valley, Hall-Mark/Philadelphia (215) 355-7300.

TEXAS: Austin, Hall-Mark/Austin (512) 837-2814; **Dallas,** Hall-Mark/Dallas (214) 231-6111; TI Supply (214) 238-6821; **Houston,** Harrison Equipment (713) 652-4700; TI Supply (713) 776-6511; R. V. Weatherford (713) 688-7406.

UTAH: Salt Lake City, Diplomat/Altaland (801) 486-7227; Standard Supply (801) 486-3371.

VIRGINIA: Roanoke, Technico (703) 563-4975.

WASHINGTON: Seattle, Almac/Stroum Electronics (206) 763-2300; Cramer/Seattle (206) 575-0907; Kierulff Electronics (206) 575-4420.

WISCONSIN: Oak Creek, Arrow Electronics (414) 764-6600; **West Allis,** Hall-Mark/Milwaukee (414) 476-1270.

CANADA: Calgary, Cam Gard Supply (403) 287-0520; **Downsview,** CESCO Electronics (416) 661-0220; Zentronics (416) 635-2822; **Edmonton,** Cam Gard Supply (403) 426-1805; **Halifax,** Cam Gard Supply (902) 454-8581; **Kamloops,** Cam Gard Supply (604) 372-3338; **Moncton,** Cam Gard Supply (506) 855-2200; **Montreal,** CESCO Electronics (514) 735-5511; Future Electronics (514) 735-5775; Zentronics (514) 735-5361; **Ottawa,** CESCO Electronics (613) 729-5118; Future Electronics (613) 232-7757; Zentronics (613) 238-6411; **Quebec City,** CESCO Electronics (418) 524-4641; **Regina,** Cam Gard Supply (306) 525-1317; **Rexdale,** Future Electronics (416) 677-7820; **Saskatoon,** Cam Gard Supply (306) 652-6424; **Vancouver,** Cam Gard Supply (604) 291-1441; **Winnipeg,** Cam Gard Supply (204) 786-8481.

CALENDAR

SEPTEMBER

Sept 1 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 PM. For more details write BAMUG, 1211 Santa Clara Ave., Alameda, CA 94501.

Sept 3 Ventura County Computer Society (SCCS) meets at 7:30 PM in the Camarillo Public Library, located at 3100 Ponderosa Dr., Camarillo, CA. For more information write: VCCS, P.O. Box 525, Port Hueneme, CA 93041 or call (805) 985-2631

Sept 3 Louisville Area Computer Club will meet in the Speed Auditorium at the University of Louisville at 1 PM. Call Glenn Darwin at (502) 426-3344 for more details.

Sept 3 Milwaukee Area Computer Club will meet at 1 PM at the Waukesha County Technical Institute, New Berlin, WI. Call (414) 246-6634 for further details.

Sept 7 Valley Computer Club holds its meeting at the Harvard School at 7 PM. The Harvard School is located at 3700 Coldwater Canyon, Studio City, CA.

Sept 7 Amateur Computer Society of Columbus will meet at 7:30 PM at the Center of Science and Industry. For further information call Fred Hatfield, President, (614) 486-3347.

Sept 7 New England Computer Society will be meeting the first Wednesday of each month in the cafeteria of the MITRE Corp. at 7 PM. Located on Rte 62 in Bedford, Mass. Contact Dave Day at (603) 434-4239 for details.

Sept 9 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 PM. Call Bob Latham at (504) 722-6321 for more information.

Sept 9 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8. This meeting will begin at 6:30 PM. For more information contact NNJACC, 593 New York Avenue, Lyndhurst, NJ 07071.

Sept 10 Oklahoma Computer Club will hold its meeting at the Belle Aisle Library at 10 AM. Call Al Campbell at (405) 842-4933 for details.

Sept 10 The Permian Basin Computer Group — Odessa Chapter meets at 1 PM in the Electronic Technology Bldg., Room 203 on the Odessa CollFge campus. For further information call (915) 332-9151.

Sept 10 South Central Kansas Amateur Computer Association meets the first Saturday of each month at 9 AM in the Wichita Public Library, Wichita, KS. Call Cris Borger at (316) 265-1120 or Dave Rawson at (316) 744-1629 for more details.

Sept 11 North Orange County Computer Club will have its meeting at Chapman College, Orange, CA. Doors open at 12:00. 1-5 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-9722 evenings.

Sept 11 Trace will be meeting at the Ontario Science Center at 2:00 PM at 770 Don Mills Road, Don Mills Ontario. Club address is Box 545, Streetsville, Ontario, Canada L5M2C1

Sept 12 The Permian Basin Computer Group in the Midland area meets the second Monday each month at 7:30 PM in the Student Union Bldg. on the Midland College compus. For additional information write John Rabenaldt, Box 3912, Odessa, TX 79760.

Sept 12 Arizona Computer Society meets on Tuesday at 7:00, Room 226, DeVry Institute, 4702 N. 24th St., Phoenix, AZ.

Sept 14 Homebrew Computer Club meeting will begin at 7 PM in Menlo Park, CA. The Stanford Linear Accelerator Center Auditorium is the site of the meeting. Call (415) 967-6754 for details.

Sept 15 New York Amateur Computer Club meets at 7 PM. Call Bob Schwartz for meeting place at (212) 663-5549.

Sept 18 Chicago Area Computer Hobbyist Exchange (CACHE) will meet at 12 PM in the NIGAS Bldg. cafeteria. The NIGAS Bldg. is located on Schermer Rd. in Glenview, IL. Call CACHE Hotline (312) 849-1132 for complete details.

Sept 21 Homebrew Computer Club will be meeting at the Stanford Linear Accelerator Center Auditorium at 7 PM in Menlo Park, CA. Call Bob Reiling at (415) 967-6754 for more details.

Sept 22 Space Coast Microcomputer Club will hold its meeting at 7:30 PM at the Merritt Island Library, Merritt Island, FL. Contact Ray Lockwood at (305) 452-2159 for details.

Sept 23 Trace will hold its meeting at Humber College (N. Campus), Rexdale, Ontario, Room 5209 at 8:00 PM. Club address is Box 545, Streetsville, Ontario, Canada L5M2C1.

Sept 28 Sacramento Microcomputer Users' Group meets 7:30-9:30 PM at SMUD Training Bldg., 59 St. between Folsom & "S" Sts. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5 PM.

Sept 28 Homebrew Computer Club meeting will begin at 7 PM in Menlo Park, CA. The Stanford Linear Accelerator Center Auditorium is the site of the meeting. Call (415) 967-6754 for details.

Sept 30 Washington Amateur Computer Society has scheduled its meeting to be held at the Catholic University of America, St. Johns Hall. Located at Michigan and Harewood Aves in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 AM and 12 PM.

OCTOBER

Oct 2 North Orange County Computer Club will have its meeting at Chapman College, Orange, CA. Doors open at 12:00. 1-5 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-9722 evenings.

Oct 5 Kitchener-Waterloo Microcomputer Club meets at 7 PM in Rm. 3388, Bld. Engineering 4, University of Waterloo, Canada.

Oct 5 Valley Computer Club holds its meeting at the Harvard School at 7 PM. The Harvard School is located at 3700 Coldwater Canyon Ave., Studio City, CA.

Oct 9 Trace will hold its meeting at the Ontario Science Center, 770 Don Mills Road, Don Mills, Ontario at 2:00 PM. Club address is Box 545, Streetsville, Ontario, Canada L5M2C1.

Oct 13 Mid America Computer Hobbyist holds its meeting at Commercial Federal Savings & Loan, Bellevue, Nebraska at the intersection of Galvin Rd. & U.S. Hwy 73-75. Write P.O. Box 13303, Omaha, NE 68113.

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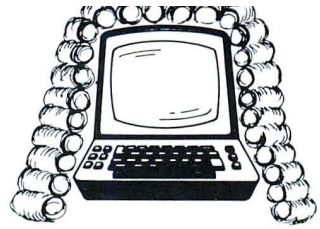


THE JURISPRUDENT COMPUTERIST

By Elliott MacLennon, J.D.
Stephan Murtha

RAISING MONEY FOR YOUR BUSINESS: TACTICAL CONSIDERATIONS; WAYS AND MEANS

Virtually all forms of business require periodic injections of venture capital for a myriad of reasons. This article proposes to briefly discuss the certain business parameters obtained through analysis prior to a company generating a plan to attract investors. Tax planning and security law considerations are noted and followed by a short discussion of several investment vehicles.

GENERAL BUSINESS CONSIDERATIONS: In determining which source of capital will best serve its needs the company should first decide on the relationship between debt and equity.

Debt financing is attractive to investors in that they are assured a steady return on their investment usually evidenced by a fixed or determinable rate of return (interest) over a given or determinable period of time.

Equity financing is attractive to investors because the money they inject into a business (venture capital) entitles them to an ownership interest in the company, and based on the company's continued success, a right to participate in profits.

To be sure, the company and investor seek the same goal: profit, and frequently they agree on the profit time frame. Moreover, they frequently agree on the means to obtain that goal. Where the company and investor are at loggerheads with one another is over the flexibility vs. protection issue.

The company wants to retain flexibility to make business decisions in the areas of business expansion, specific product development, and future financing to cite a few examples. These decisions the company will usually seek to make without having to invite investor participation.

The investor's position may well be characterized by a statement made by Andrew Carnegie, the late American steel magnate. "Put all my eggs in one basket," he remarked in passing to a friend, "Why, I do it all the time, I just watch that egg basket awful close." The investor will want to participate in those decisions that affect his interest.

Understandably, the company will want to adopt a strategy that achieves a predetermined balance between debt and equity. The acquisition of too much debt will, in addition to burdening its cash flow to repay the outstanding debt, mortgage its future earnings.

Too much equity financing on the other hand may dilute the original principals of the company's ownership interest, and where a large block of equity is in the hands of a few investors, control of the company may be destabilized, threatened and even overcome.

TAX CONSIDERATIONS: Essential in the planning of acquisition of venture capital is consideration of the tax impact of the proposed investment. As with selection of the investment vehicle the choices available must be examined by the company for its own point of view as well as anticipating the investors' needs.

Tax planning may not only affect the form of investment, for example, a debt instrument, but even that of the organization of the company itself: Corporation vs. Limited Partnership or Trust.

Does the investor need a loss generated to offset the income from another source? If so business start-up losses may pass through to the investor if the company is organized as a Subchapter S Corporation.

Does the company need additional deductions to offset high income? A debt instrument may be more suitable here as opposed to an equity instrument like common stock because interest paid on a bona fide debt is deductible to the company, whereas the payment of a dividend is not deductible; it only reduces the company's earnings and profits.

Further consideration such as planning the transaction to ascertain if the investor or the company gets the benefits of depreciation and investment tax credits.

Often of critical importance from the investor's perspective is the tax character of the return on the investment: Capital gain or loss; ordinary gain or loss, usually the investor will want a capital gain or an ordinary loss as opposed the combination of the remaining two variables because in the world of tax alchemy this combination yields the smallest tax exposure for the investor.

Tax planning is largely tactical in nature and operation. Once a tax decision is made, its permanence is a function of the stability of the facts which originally generated the decision. Simply put, tactical tax elections stay put as long as the facts underlying the election don't change.

For example, a lease as a form of investment vehicle is attractive where a company can finance the acquisition of a needed asset owned or purchased by an investor absent the outlay of substantial funds as perhaps required by a downpayment, thus, the asset, or its use, can be procured while freeing funds for working capital. The lease transaction becomes especially attractive where the company is already operating under a net operating loss whereby the tax write-off aspects of asset ownership are of minimum benefit. The investor, as it frequently occurs, may need the tax benefits of ownership in order, for example, to offset other income. The tax saving the investor realizes may result in a lower rental cost to the com-

pany, thus, the company inexpensively acquires a needed asset where again in turn the reduced rents received by the investor serve to keep his income lower than would a full rental value, thus, giving his deductions resulting from ownership more tax leverage.

Of more importance is viewing tax planning as an isolated tactic, and in turn viewing investment options provided to the investor also in an isolated plane. The two can be combined additively in that the investment options may produce a conflict between company and investor, whereas tax planning may produce harmony.

It follows that the company may wish to relinquish certain tax benefits to itself which contain little or no significance where conversely the tax effect substantially affects the investor. His example of flexibility of bargaining power may gain the company a needed advantage, such as retention of management control traded off for a tax election favorable to the investor. This form of tactical combination makes for good overall investment acquisition strategy. It is similar to the combination of two-dimensional chess.

SECURITY LAW: Prior to making a brief mention of the advantages and disadvantages of various investment vehicles, it is of critical importance to point out that the company must make sure that the proposed investment transaction complies with all securities law including both Federal and State or serious penalties including civil and criminal can result. Security law is mainly concerned with problems of "watered-stock." Both federal and state agencies involved in regulating the issuance of equity instruments or convertible instruments, such as debt that can be transmuted into equity, seek to protect the public who purchase an ownership interest in a given company, creditors who loan money, goods or provide services to the company, and in general, all those who rely on the stated worth of the company as bona fide.

The question of what is a security is pregnant with reply: It can be a share of common stock, an orange grove, or in some instances an oral agreement.

INVESTMENT VEHICLES: COMMON STOCK: Secures permanent capital for the company without incurring an obligation to pay back the investor at a fixed rate over a given or determinable time period.

Its disadvantage from the viewpoint of the principals of the company is that it dilutes their ownership interest and ability to control management. This latter effect can be mitigated somewhat by shareholder agreements, voting pools or voting trusts between the company principals, as common stock usually carries with it full voting privileges.

The investor takes an equity investment risk by purchasing common stock. For this risk the investor gains the opportunity of substantial return without running afoul of usury problems.

OTHER FORMS OF STOCK: Preferred stock as distinguished from common stock usually contains certain rights, privileges and preferences unknown to common stock.

The company may wish to provide these additional features to initially attract the investor while, as is frequently is the case, add these features while taking away the voting privileges of this form of stock, thus preventing dilution among company principals.

A non-exhaustive list of the type of rights, privileges and preference that entice investors would be a right to participate in dividends prior to common shareholders receiving any dividends, a right to cumulative dividends, a liquidation preference on termination of the company and a convertible feature on the preferred stock converting it into common stock in anticipation of a public offering.

WARRANTS AND OPTIONS: Warrants and options, when combined with debt instruments, allow the company a means of obtaining working capital while at the same time postponing the investor's equity investment decision.

The investor can achieve two basic objectives by the use of an option or warrant: Participation in future appreciation of the company's worth and minimization of the downside risk through postponement of the equity investment decision until a favorable investment climate occurs.

DEBT INSTRUMENTS: The choice of a debt instrument, rather than equity instrument, as the investment vehicle is fundamental. The holder of the debt instrument is a creditor rather than an owner of the enterprise. Debt instruments including promissory notes, debentures bonds, are essentially similar in that they represent a promise to pay a stated amount to the holder at a fixed or determinable time.

In addition to gaining a deduction for interest payments the company gains capital leverage by obtaining present capital financed through debt instruments while spreading out the repayment period often over several years.

The investor can bargain for security on his contribution to guarantee his chance of repayment. An injection of capital through an equity instrument provides no such guarantee.

A non-convertible debt instrument is not, in most jurisdictions, held to be a "security" and is therefore exempt from security law registration.

COMBINATIONS OF DEBT AND EQUITY: Frequently a combination of debt and equity financing produces the advantages of each while minimizing the disadvantages of both. If a conversion feature is present to convert debt into equity the conversion ratio or purchase of the underlying instrument must be specified. The exercise period must also be stated.

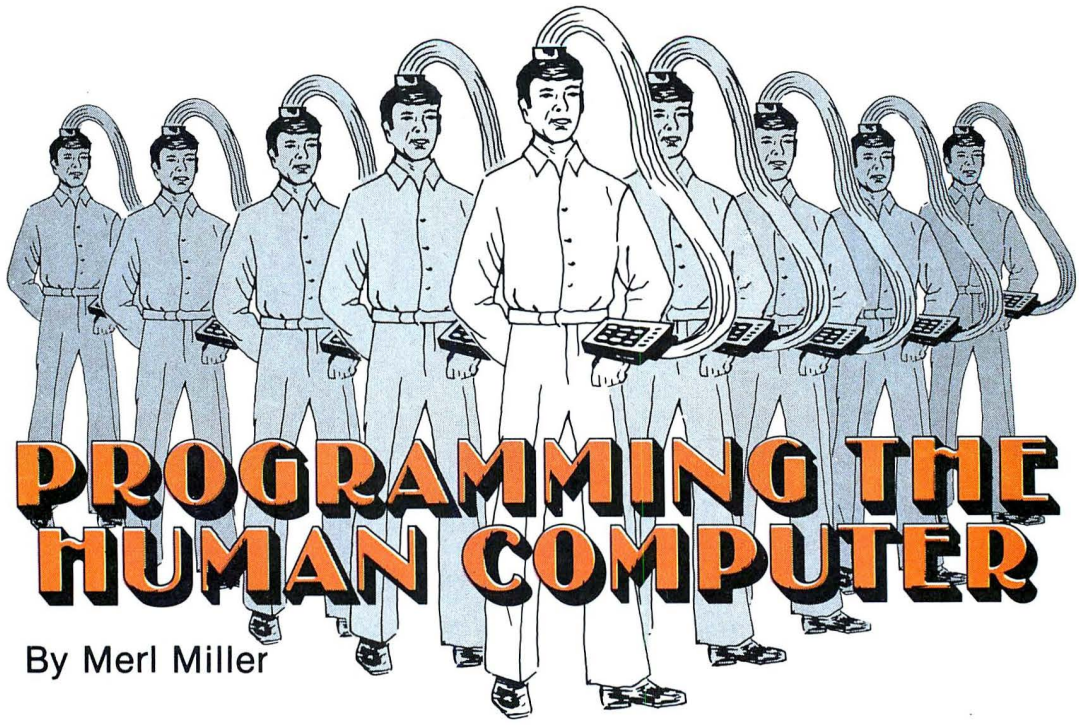
Careful attention must be paid to the value of the conversion feature. If the interest payable on the debt is the maximum permissible under state law, the addition of a value for the conversion feature may render the transaction usurious.

Tactically, it is in the company's favor to be able to prepay the debt and force conversion; the opposite is true for the investor in that control over the timing of the conversion is lost.

The company seeks the often inconsistent but not elusive goals of raising maximum capital while minimizing dilution, thus, retaining the reins of control over business operations and planning.

The investor will look for maximum return for a minimal investment with the strongest guarantees of security available including more often than not the right to participate in decisions affecting in any significant way his at risk interest.

Although often in diametric opposition to one another both the company and investor retain the same profit-making or profit-enhancing goal. This goal is the genesis of the working agreement between the two. The company, by carefully analyzing its future financial needs and anticipated profit projections, can offer to the investor what sometimes may at first appear to be a poverty of options which in reality can be a panoramic selection of choices offering the investor a tailor-made investment vehicle suitable to both parties by the use of creative business and tax planning bargaining power.



PROGRAMMING THE HUMAN COMPUTER

By Merl Miller

HOW AND WHAT TO SUBMIT TO A BOOK PUBLISHER

This month, we are going to talk about your book writing ability. Writing a book should be an enjoyable and rewarding experience for an author. One of the first things to consider is what to submit for review and how to submit it.

A publisher will always consider the complete manuscript, but the publisher can make a publishing decision on the basis of a detailed outline, two or three representative chapters and a prospectus. This material is sufficient because it gives the reviewer a good grasp of the material and allows him to evaluate the author's style, pedagogy and technical competence. The publisher may have from one or ten or more reviewers comment on the material, but the norm is two or three.

The publisher will decide to do one of three things: publish the book, reject the book, or return the book to the author for revision. Let's take a look at these three options. If the publisher wants to publish the book, how do you decide to accept publication with that house? Publisher's royalty schedules, book production capability, and marketing abilities vary greatly. Royalties are normally paid on net proceeds from the sales of the book. Net proceeds mean actual monies the publisher receives, or is due to receive, from accounts receivable. The royalty scale varies from a low of 10 percent to a high of 25 percent. Marketing ability is something you'll have to judge for yourself. One good criterion is to start with the publishers with whom you are most familiar, but be sure you are dealing with a legitimate publisher, not someone who publishes books as a sideline. Remember, there is more to publishing a book than just printing what the author submits.

Now let us look at the other two alternatives. If your book is rejected, find out why, revise it as necessary and submit it to another publisher. If the publisher returns the manuscript for revision, try to make all of the suggested revisions and add something. You should be able to tell from the publisher's comments what the reviewer does and does not like about your manuscript. Change what he doesn't like and add more of what he does like.

As for the physical preparation of the samples, it is best you prepare three copies, submit two copies, and keep one copy for yourself. The manuscript should be typed, double-spaced, and include any charts, graphs, and photographs that you feel are pertinent. However, the material does not have to be in perfect form. The emphasis on preparing the material should be on readability.

Now, let's consider the samples themselves, the representative chapters, detailed outline and the prospectus. You should pick two or three chapters you consider to be an integral part of the book, and they should be in the best possible form, but you do not have to follow a specific order. For instance, you could submit Chapters One, Three and Six of an eight-chapter book, as long as you feel those chapters represent what you are trying to do and they put your writing style and pedagogy in the best possible light. It is a good idea to submit any chapter which you esteem to be particularly innovative or unique. You should, however, include Chapter One. If a customer in a book store, or computer store, picks up your book, he will probably glance through Chapter One. Chapter One may determine whether or not the book sells, so the publisher is keenly interested in this chapter.

The detailed outline should encompass the entire book, including the chapters submitted. This gives the reviewer an idea of how the remaining chapters are to be developed. It should include chapter headings, sub-headings, sub-sub-headings, quotes and explanations of each as necessary.

If possible, it should be in this form:

Title of Book
1. Chapter title
   A. first subject
      1. first topic sentence description of topic

2. second topic
sentence description of topic

B. second subject
1. first topic
etc.

2. Chapter title
A. first subject
1. first topic
etc.

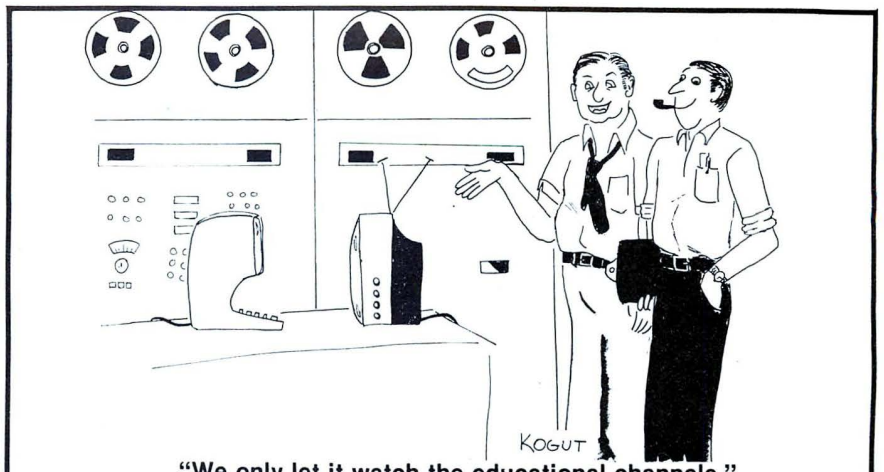
The prospectus, simply stated, is an abstract of the book, with market considerations. You should say for whom your book is intended and why. It is not sufficient to say it is intended for computer hobbyists. You should point out what background you expect your readers to have. For instance, you could say, "This book assumes the reader has a fundamental background in microcomputers such as that provided in Diday's *2^{10} Questions and Answers about Home Computers.*" You should look at the existing books, and compare your book to them. Discuss in your prospectus specifically what are their weaknesses and strengths, then spell out why your book is better. If your book competes with, say, half of another book, it is a good idea to include that book, so the reviewer and publisher have some basis on which to compare your material. This is particularly true if you are writing a book in an area where there are no books. The prospectus should be written for the reviewer, but, if at all possible, it should be at a level the editor, who usually has little technical background, can understand. Last, and probably most important, ask yourself this question. "Given the detailed outline and the representative chapters, what else can I say to the reviewer to put my book in the best possible light?"

Once you have your manuscript in hand, you are ready to contact publishers. You can find most publishers' addresses in the *Literary Market Place.* This book is available in the reference section of your library. I will give you one address, however . . . mine! It is:

dilithium Press
P.O. Box 92
Forest Grove, OR 97116

This should get you started, but don't let it scare you off. It sounds like much work, and it is, but book writing can be quite rewarding. What I have outlined is the ideal. It will get the best results for you. Please keep in mind, the main purpose in sending your material to the publisher is to sell him on the idea of publishing your book. How good a sales job you do it up to you.

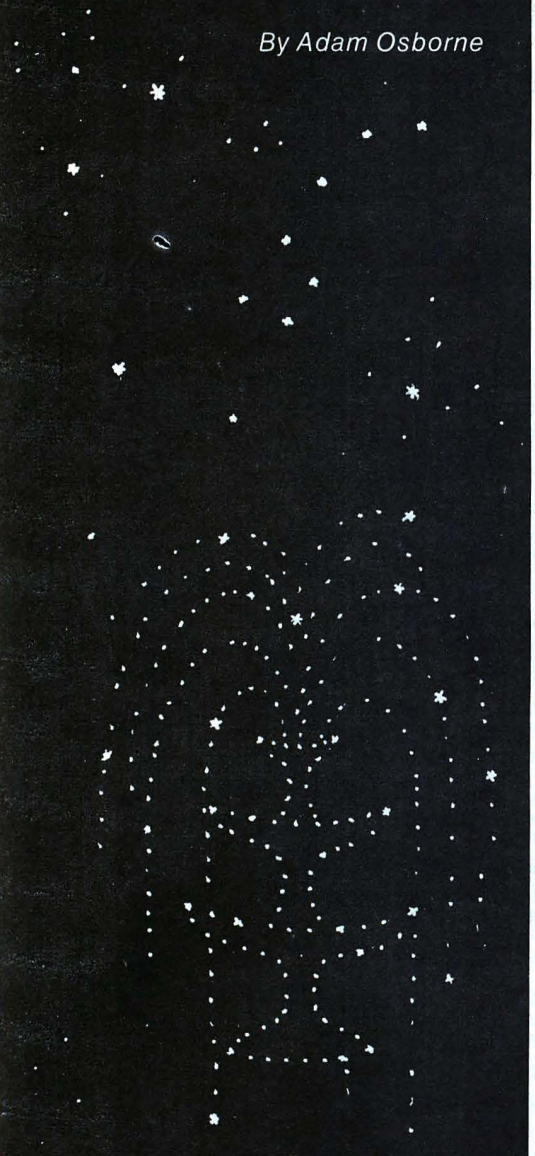
Next month we will take a look at article writing.

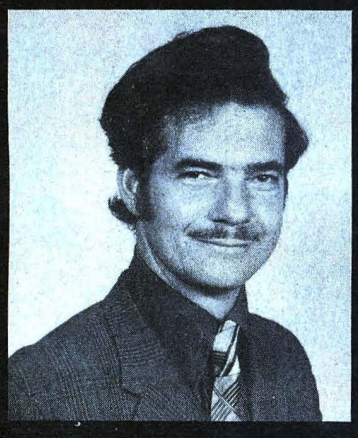


"We only let it watch the educational channels."

. . . FROM THE FOUNTAINHEAD

By Adam Osborne





My June comments regarding kits vs. assembled boards continue to raise much controversy. Bill Godbout of Godbout Electronics called asking that his name be added to the list of suppliers who deal only in tested parts. After some discussion between Bill and me we reached a consensus that there appear to be two major types of company supplying hardware to hobbyists:

1) There are companies such as Godbout Electronics, Newman Computer Exchange, E & L Instruments, and for that matter, my own company, Osborne & Associates, that existed long before there was any hobby market.

2) There are companies that came into being specifically to serve the hobby market, once it had formed.

Companies that existed before the hobby market tend to buy only tested parts, because that is what they had to do in order to serve their prior industrial customer base. Many companies that were formed specifically to service the hobby market tend to buy untested parts, leaving it up to the kit buyer to test the parts by trying to use them.

I consider the discussion of kits vs. assembled boards, and tested vs. untested parts, to be still wide open. If you have any opinions on this subject, please call me. My telephone number is 415-548-2805.

With the burgeoning use of microcomputers in data processing and other software intensive applications, I have some words of warning for anyone selling programs or writing programs for money. My warning applies also to anyone buying software. Some ridiculous and ill conceived laws cover sales tax when applied to software. California's software sales tax laws are particularly unreasonable, and clearly the work of bureaucrats who do not have the remotest understanding of the subject that they are trying to regulate.

In the State of California, if you deliver your software to a customer in the form of paper tape, cassette, floppy disc or any such computer readable surface, then the State will take the total cost of software development as being part of the price subject to sales tax. On the other hand, if you do not deliver the programs in this computer-readable form, but rather you do so on a piece of paper (or by mental telepathy), then all the time you spent creating programs becomes a service, not subject to sales tax.

If you have written a contract with someone that says you will write programs for a certain amount of money, then that programming charge will be subject to sales tax, whether it is a fixed sum or an hourly sum. When you present your bill you had better add sales tax to it, or the California Franchise Tax Board will come after you to pay the sales tax out of your own pocket. There is, however, a simple method of writing your contracts to avoid paying sales tax.

When you write the contract specify a fixed large sum of money for programming services; the deliverable item at the end of this part of the contract must be a documentation package. Add another small separate sum of money to cover the cost of key entering the programs from the documentation package, and storing them on paper tape, cassette, or floppy disc. Include the charge for the paper tape, cassette or floppy disc as a separate item. Now your contract can clearly identify some large part of the task that was a pure service and ended with a documented package. You will only be charged sales tax for the floppy disc, paper tape or cassette, plus the expenses associated with getting the usable programs onto this medium. Now just to highlight how ridiculous the California laws are, if—by chance—the floppy disc, cassette or paper tape which you delivered to your customer was created during the process of debugging your programs, then the whole program writing charge becomes subject to sales tax. The key to keeping out of trouble is to have a separate, small item in your contract covering the cost of creating the programs in a computer readable and deliverable form; the fact that they had to exist in this form while you were debugging the programs is not relevant. Just make sure you go through the whole key entry step again and the law will be happy. Since the law has made your life more difficult, your product more expensive, and your profession less efficient, the bureaucrats must be happy.

If you are in the programming business outside of the State of California, I suggest you carefully examine the sales tax laws in your State, as they apply to software, since the asinine California laws are not unusual.

It begins to look as though 1978 will be the year of the 16-bit microprocessor. We already have the LSI-11 Heathkit. The LSI-11 is not strictly a microprocessor; it is a

minicomputer on a board, however, the demarcation between minicomputers and microcomputers is getting distinctly blurred. Fairchild is now producing its 9440 16-bit microprocessor in commercial volumes; this device has the same instruction set as the Data General Nova minicomputer. In the not too distant future you will be able to get 9440 based CPU cards for your S100 bus microcomputer. Texas Instruments, who for a long time has ignored the microprocessor market, is now finally stirring; and we can expect to see some significant development based on the TMS-9900 microprocessor. The few companies manufacturing hobby computer kits based on the TMS-9900 might be struggling today, but if Texas Instruments really comes through with their plans for 1978, the kit manufacturers will be glad they chose the TMS-9900. There will also be two significant announcements in 1978: both Intel and Zilog are working on new 16-bit microprocessors, to be announced during 1978. Intel's 16-bit microprocessor follows the general concepts and designs of the LSI-11. Initially 16-bit central processing units will sell for prices ranging from between $1,000 and $1,500; however, these prices are likely to fall fast.

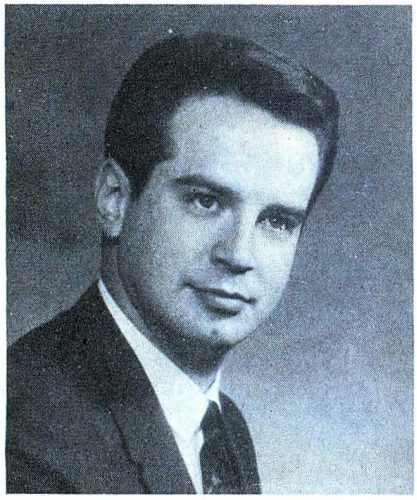
This might be a very opportune time for some enterprising hobbyists to write programs that will read Intel 8080A source code and generate LSI-11 executable object code. Do not sell this program, rather keep it as a service; charge a fee to convert 8080A source programs to LSI-11 object code. In all probability the 8080A will cease to be the most popular hobbyist microprocessor within another couple of years; it will be superseded by one the new 16-bit mircoprocessors, possibly the LSI-11.

A few months ago I mentioned Tom Dilatush who offers a service completing half assembled boards, and debugging problems in assembled boards. I had a call from Cary Fitch who operates the Computer Store in Jacksonville, Florida. Cary Fitch commented that most computer stores offer Tom Dilatush's type of service, so why would an independent be in business? My most recent soundings indicate that, many but not all computer stores offer board completion and diagnostic services. Many stores claim that it is not worth the hassle, or that it is not profitable. Perhaps stores should farm this type of work out to their most reliable and knowledgeable hardware oriented customers.

"My computer doesn't understand me."

SENSE LINE

Bob Jones



All too often a person's good intentions and enthusiasm for an avocation become stagnated by disappointment after awakening to the real world. You've had it happen to you a dozen times, when something you bought didn't meet its specifications in your application. You then were forced to modify it in order for it to work, or you returned it.

But what happens to the computer club you joined and decided doesn't meet your needs? Do you ask for your money back, or do you try to change it to meet your, and possibly others', needs?

Well, before you do anything you best understand what you are in for if you are going to try out your ideas. Let's begin by exploring the origin. Usually a computer club is formed out of necessity by generally two types of people: the technically sincere and the empire builder. Its goals are simple: to socialize, to exchange software, and to solve hardware problems. The first meeting of the club produces several by-products as a small group: annual dues of $2 to $5 and a management staff which more or less will be comprised of the most technically competent of the group. Among this staff you will find at least one who wants to build up the organization into a larger more encompassing society. He is the "empire builder" and the one who eventually will win out if his enthusiasm and interest don't wear out first.

Since microcomputers are an "emotional market," that is to say young and dynamic both in product development and commercial recognition, everyone wants to join on the bandwagon. What impact does this have on the club? UNCONTROLLED GROWTH, that's what. Not so, you say; then show me a club who has restricted its size and turned away potential members.

The club grows from twenty to seventy members overnight. The staff is secure in its goals, the board of directors (an idea from the empire builder) are elected and incorporation into legal form formally begins. (You just left the first goal behind, as stated when you started the club.)

In most states a simple informal group may exist without the necessity of incorporation provided that no commercial or monetary ventures are embarked upon. Normally a listing with the county clerk and filing a tax form, however, is required.

Here is where most all clubs get into trouble of some sort. When they incorporate in their state they are looked upon as a **business**, both by the state and by the IRS. But what is running the business is a staff of volunteer technical people whose sincere intent really wasn't to go into business with all the burdens, encumbrances and responsibilities that a business has, but to enjoy itself, and their friends.

Now someone else enters the picture (the empire builder's next door neighbor) and suggests that the club must do something more for its members — like maybe buy component parts and peripherals as a group and save money! Any volunteers to handle this project? But how do we let all the new members know about this new service? With a newsletter, how else? We need a newsletter editor — any volunteers? And so goes the scenario. Most of you know the rest. The hundreds of volunteer hours put forth in order to try to make the clockwork tick. Unfortunately, many people wear out in the mainstream of the first year's existence and fifteen percent of the original staff are now doing ninety percent of the work while the club continues to enjoy its successful growth towards infinity. Or the club's back breaks and it passes into immortality.

If the obvious hasn't dawned yet, let me clarify. Back in the beginning when the club saw that the growth dynamics were going to be phenomenal it could have hired a professional business manager (part-time, initially) to run the administrative end, leaving the fun and games untangled. The club's dues should have been raised to $15 to $20 per member (which also slows down rapid growth into a controllable form), to help finance the professional business manager. He in turn could have brought in additional revenues by going after grants and business opportunities. A good business manager can generate far more than his annual salary for the club's benefit. He also can administrate a whole host of club benefits besides a group purchase plan and newsletter/magazine. How about a group dental/medical and life insurance plan, group travel plan, negotiate for hardware and club software library from industry; create public awareness and build club identity, develop community involvement, computer fairs and other revenue generating activities on a professional full-time basis.

Hey, wait a minute! This doesn't sound like any non-profit club to me! Well, look around. How many clubs are trying to provide all or part of these benefits now? Most all of the above can accrue to a non-profit club, but its success rests entirely on sound business planning and management, a good accountant and close legal advice to maintain the club's operation within IRS guidelines of non-profit organizations.

Keep it simple and small and you won't have too many traumatic problems. If you allow your club to grow uncontrolled, without professional help, the long term stability of the club will almost assuredly be disastrous.

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Manuscripts should be double-spaced, typewritten pages, one inch margins, and not less than 3½ pages in length (one published page). Pages should be numbered to insure correct text. Photographs should be numbered and labeled on the backside with a description. Tables, listings, etc., shall be on separate sheets. Photos should be taken with uniform lighting and background, in the form of glossy black and white prints. Computer listings shall be printed using a new ribbon to assure darkest print copy. Authors shall supply a statement of their background, expertise and level of accomplishment.

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For article submittal or further information, contact respective editor, INTERFACE AGE Magazine, 13913 Artesia Boulevard, Cerritos, CA 90701 or call 213-926-6629.

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THE FLOPPY ROM™ #2

(Happy Computing with a General Ledger Account Program)

By popular request this month's Floppy ROM™ is a business program rather than a software development program. The reception to Bud Shamburger's General Payroll Package in the June issue was overwhelming with many additional requests for his General Ledger Package to be featured on a Floppy ROM™. This provided us not only a good technical challenge but also an editorial problem. Therefore, a few words are in order regarding the following business article. It will become immediately evident that a general ledger program worth its salt will be extensive in length and description.

From an editorial point of view the listing alone comprises over 80 pages not including the text. When you consider the amount of programming and the space which it must occupy on a Floppy ROM™ you realize that the Kansas City Standard and 300 baud will never cut the mustard on a 6-inch disc.

Now the Floppy ROM™ must reenter the experimental domain for higher baud rates and complexities. The results were quite pleasing as 1200 baud proved to be no problem for the crew and equipment at Eva-Tone, nor for those who spent long hours in preparing the program prior to transcription. Hats off to the good people at the Chicago Computer Store, Inc., Park Ridge, IL, who provided the computer equipment and technical expertise in the form of Lou Van Eperin, president; Jim Rembis, senior technician; and Terry Marshall, graduate student Northwestern University.

As most of you are aware the first Floppy ROM™ took nine months to debug and produce. Under the direction of Bill Turner and Bill Blomgren they were able to overcome the hardware and software idiosyncrasies in less than a week for this program. It has become quite clear that for future Floppy ROMs we will have to standardize on hardware that allows the maximum flexibility for the user to feed the data from the Floppy ROM™ directly into a computer. The philosophy behind this concept is that the original recording is made directly from a computer output to the master cutting head on a first generation basis. Having to record it on a tape subsequently provides at best a second generation program which potentially could contain bugs.

Over the next two issues we are providing in serial form the balance of the program source code so that you may take advantage of this program to tailor it to your own systems requirements. In some cases this will be very straightforward and in other cases may require a liberal amount of massaging. For those who have an Altair™ system containing 48K+ bytes of RAM, disc and Tarbell cassette interface, the work will be little more than lifting the tone arm and recording.

Should you have any technical questions regarding the program featured on the Floppy ROM™, I suggest you direct any inquiries to either Lou Van Eperin, Chicago Computer Store, Inc., Park Ridge, IL, (312) 823-2388; or Bill Turner, Southeast Regional Editor, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.

For those interested in the answers provided by many of our readers regarding the first Floppy ROM™ in the May 1977 issue, we will be publishing the results in our November issue. I strongly urge those of you who work with this month's Floppy ROM™ to please answer the survey questions listed as they will directly influence our future Floppy ROM™ activities. Good Luck!

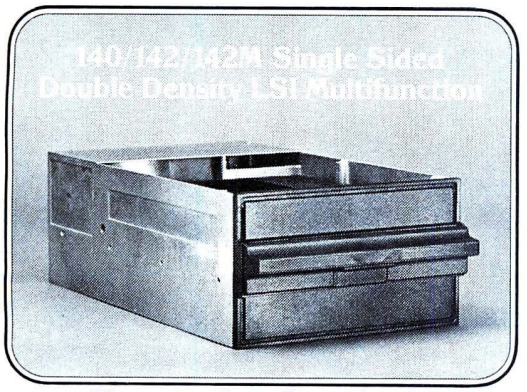
SURVEY

QUESTIONS

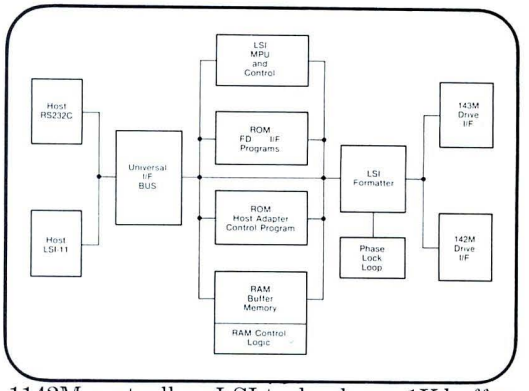
1. Did your magazine with the Floppy-ROM™ arrive in good condition via the Post Office? ☐ YES ☐ NO
2. What kind of record player did you use? Approximate cost? _____
3. What type of cartridge is on your turntable, ☐ magnetic or ☐ ceramic? If you know, tell us the brand and model. _____
4. Whose 8080A system did you use? Tell us the manufacturer's name, not your friend's. _____
5. What is the memory size of the 8080A system and what peripherals do you have? _____
6. Did you have trouble loading the record? ☐ YES ☐ NO If yes, what? _____
7. How many times did you have to try loading before you were successful? _____
8. Did you have any difficulties that prevented it from operating at all? If so, what were they? _____
9. Did you try loading the computer directly from the record through the interface? ☐ YES ☐ NO
10. What kind of tone control settings did you use and were they critical? _____
11. Was the playback level critical? ☐ YES ☐ NO
12. Did you play it back in ☐ monaural or ☐ stereo?
13. Do you like the Floppy-ROM™ concept? ☐ YES ☐ NO
14. What kinds of programs would you like to see in the future? _____

See page 33 for a listing of programs on the General Ledger Floppy-ROM™

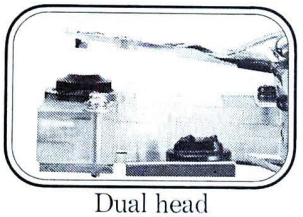
Meet the First Family in floppies.



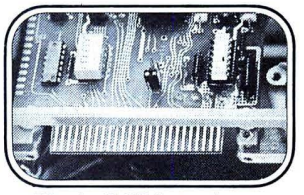
The roots of our floppy family



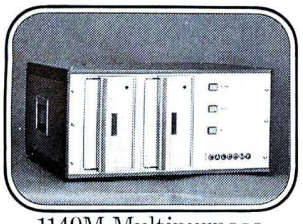
1143M controller • LSI technology • 1K buffer



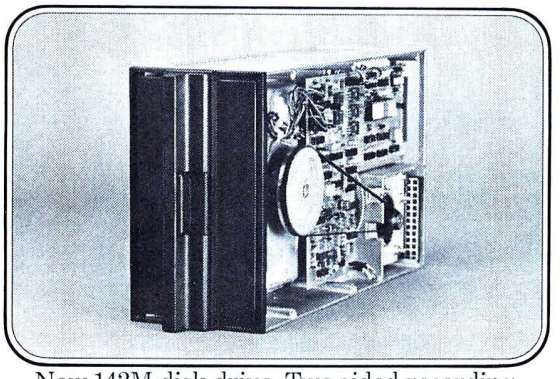
Dual head



50 pin LSI interface



1149M Multipurpose Cabinet assembly. Rack or table mounted.



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General Ledger Program

—BSGLP — The Micro Bookmaker

Part 1 of Three Parts

By Bud Shamburger

FOREWORD

This is the second of a series of software features on business application programs by Bud Shamburger. This second article covers a Motel General Ledger Software Package developed by the author for his 78-unit Ramada Inn. Because of its size, the General Ledger Package will be published in the following three parts:

- GENERAL LEDGER PACKAGE DESCRIPTION & PROCEDURES
- GENERAL LEDGER PACKAGE OUTPUT EXAMPLES
- GENERAL LEDGER PACKAGE BASIC PROGRAMS

The General Ledger outputs include the following:

- MONTHLY BANK STATEMENT
- GENERAL JOURNAL
- BALANCE SHEET & OPERATING STATEMENT
- MONTHLY BUDGET
- YTD BUDGET
- MONTHLY STATISTICAL REPORT
- YTD STATISTICAL REPORT
- YEAR TO YEAR INCOME & EXPENSE COMPARISONS
- AVERAGE DAILY ROOM RATES MONTHLY & YTD
- OCCUPANCY RATES MONTHLY & YTD
- CASH FLOW ANALYSIS
- SPECIAL SORT PROGRAM WHICH REARRANGE THE DATA FILES TO PRODUCE THE ABOVE REPORTS

The General Ledger Software Package includes the following BASIC programs:

- CHECK TRANSACTIONS
- LEDGER TRANSACTION
- MERGE BANK BACKUP WITH LEDGER & CREATE NEW BANK CURRENT
- CHECKS CASHED & TAG BANK CURRENT
- BANK STATEMENT
- DAILY ROOM REVENUE JOURNAL VOUCHERS
- MONTHLY OR YTD BUDGET — MONTHLY OR YTD ANALYSIS
- COPY FILES
- MAKE MASTER CHANGES
- SORT GENERAL LEDGER FILES
- COPY BUDGET FILE TO BUDGET HISTORY FILE
- LOADS GENERAL LEDGER CHART OF ACCOUNTS IN
- LIST THE PROCEDURES FOR RUNNING THE GENERAL LEDGER PACKAGE OF PROGRAMS
- DISPLAY ALL GENERAL LEDGER PROGRAMS AND PROMPTS THE OPERATOR AS TO THE FLOW OF PROCESSING

The author's microcomputer hardware system configuration includes:

- MITS ALTAIR™ 8080B MICROCOMPUTER WITH 64K MEMORY, 4 SIO PORTS, 2 PIO PORTS & PROM BOOTSTRAP LOADER
- TWO MITS ALTAIR™ HARD SECTORED FLOPPY DISC DRIVES
- TWO ADM3 VIDEO TERMINALS
- ONE OKIDATA 110 LINE PRINTER
- ONE MPI LINE PRINTER
- MITS 12K DISC BASIC VER. 4.0

Now to Bud's General Ledger Software Package

—Software Editor

INTRODUCTION

The micro bookmaker is, as you might expect, not a little wizen fellow with shades over his eyes answering telephones all around him located in some dreary basement. Rather he's a microcomputer, sitting on your desk or tabletop at home or office.

In my case he's an MITS ALTAIR™ 8800B sitting on a long table behind my desk at the office, and he makes book flawlessly: my books that is.

In today's fast moving world, the businessman who doesn't know where he's been, doesn't know where he's at and is unsure where he's going, makes a short journey. The guy down the street or across town has all this information. If you don't, how can you make any intelligent decisions about your business? It's one thing to get the information, and another to get it before it becomes history. Here is your answer!

GENERAL LEDGER PACKAGE

The following is a general ledger package which, when mastered, will produce your books flawlessly. If you will take the time required to master the use of the package, and have a working knowledge of bookkeeping and either know some accounting or have access to an accountant, then make all the necessary modifications to the package to tailor it to your individual situation, you too will have your micro making book for you.

Chart of Accounts

An electronic bookkeeping system is no better than the "Chart of Accounts." The Chart of Accounts is a list of all the possible accounts which you need to categorize your business transactions. Each category is assigned a number. This number is known as the account number.

Account Numbering System — The account numbering system you use is the heart of the bookkeeping system. Much care should be taken in constructing the numbering system so that maximum flexibility is attained. Some account numbering systems use three digits, some use four digits and some use six digits. I have worked with some using as many as twelve digits.

Most numbering systems assign a positional value to certain positions of the number. Certain positions of the number indicate a category. The numbering system used in this package is constructed as follows:

X	X	X	X
POS1	POS2	POS3	POS4

POSITION ONE denotes 1 = ASSETS
2 = LIABILITIES
3 = EQUITY
4 = INCOME
7 = EXPENSES

POSITION TWO denotes various departments or subcategories such as current assets, fixed assets, other assets or repairs and maintenance expense.

POSITION THREE AND POSITION FOUR denote individual categories and give you 100 numbers within each subcategory. This leaves room for skips between numbers so that similar accounts in the future may be assigned and placed within the sub-category to which they belong.

You will quickly notice that my Chart of Accounts is arranged in the order which when listed in numerical sequence, will produce a balance sheet and operating statement. This is to what I was referring earlier when I stated that much thought should go into your numbering system. Refer to Figure 34 for a look at the Chart of Accounts.

This package of programs treats the following account numbers with some unusual dimensions which more than likely will not be compatible with other businesses. So, look them over closely before using any of them:

PROGRAM	ACCOUNT #
GL2	1202, 1206, 1214, 1224, 1228, 3096, 7903 Any account above 7904
GL3	1110 (The account used here must be your general checking account)
GL6	1110, 1130, 1129, 7400, 4100, 4204, 4102, 2134, 4302, 4101, 1130, 4301 (This is an application special purpose program which you may not use)
GL7	All accounts 4000-up must have budget figures in the data table, 7904, and the cash flow routines.

Disc File Configuration

The next important consideration for a system of this magnitude is the disc file organization or configuration (see Figure 12). It is as important as the numbering system. In many cases they are very closely connected.

All of the disc files of this package, a total of eight, use the same basic record layout. Refer to Figure 12 for the actual layout. You will notice that there is a small variation within the record depending on the type of record. The fact that all basic records are the same makes for ease of programming.

General Ledger Disc Files

All disc files contain blocked records, that is each disc sector contains more than one ledger record. In this case they contain three ledger records per disc sector. Each ledger record is 42 characters long, leaving two unused spaces per disc sector. Using blocked records allows us to pack more data per floppy disc and also speeds processing time. One floppy will hold 6108 ledger records or an average of 509 per month for a 12-month period. The programs will flow over floppys.

All of the disc files are random files except the "Budget" and the "Budget History" files. The file assignments are as follows:

FILE	DISC AREA
1. **LEDGER (CURRENT)**	0001-2037 (One complete floppy)
2. **LEDGER (BACKUP-BEFORE)**	0001-2037 (One complete floppy)
3. **LEDGER (BACKUP-AFTER)**	0001-2037 (One complete floppy)
4. **BUDGET (THIS MONTH'S)**	Consecutive area on end of ledger current
5. **BANKCURR**	0201-0400 Floppy shared with 6 & 7
6. **BANKBKUP**	0001-0200 Floppy shared with 5 & 7
7. **BANKSAVE**	0401-0600 Floppy shared with 5 & 6
8. **BGT(MOYR)**	(Budget History consecutive files using a dedicated floppy

Files 5 through 7 can be assigned the same disc areas since they are *basic* random files, but for simplicity and because they are small files, I chose to spread them as listed above. Otherwise they are straight forward random-blocked files.

Files 4 and 8 are straight forward *basic* consecutive blocked files and are the only consecutive files in the package.

File 1, the ledger file and Files 2 and 3 which are copies of File 1 are quite unique in their arrangement. The entire *basic* random area is allotted to the ledger file. Each month's ledger is stacked in the file starting at location 0001. At the end of each month's file is a trailer record indicated as EOF. This indicates the END OF FILE. All records following this record belong to next month's ledger file. This includes the new balances produced when running this month's ledger.

Sector or Record 2037 is considered part of the ledger file when actually it is not. Sector 2037 contains a table which is a record of the ledger month and year and the

Figure 34. Chart of Accounts

ASSETS

CURRENT ASSETS

ACCT #

1101 Cash on Hand — This is the amount of cash maintained in the cash register at all times

1102 Petty Cash — This is a miscellaneous fund used for paying incidental cash items

1110 First National Bank — General — This is the general checking account used for depositing all receipts and paying all bills, except payroll

1111 First National Bank — Payroll — This is the bank account used for paying all payrolls

1112 First National Bank — Savings Account — Passbook savings

1113 Cash Deposits — Modern Security Life

1129 Accounts Receivable — City Ledger — This account represents all of the outstanding credit cards and direct bill accounts which have not been collected, excluding those accounts still registered

1130 Accounts Receivable — Regular — This account represents the total amount pending on those still registered

1133 Prepaid Service Charge — This account represents any prepaid charges not specifically covered elsewhere

1134 Prepaid Insurance — Hazard — Represents one full year's premium on the general peril insurance policy

1150 Prepaid Insurance — Workmens Comp — Represents one full year's premium on the Workmen's Compensation Insurance Policy

FIXED ASSETS

1201 Building — Motel & Restaurant

1202 Accumulated Depreciation — Buildings

1205 Furniture — Motel

1206 Accumulated Depreciation — Furniture — Motel

1207 Office Equipment

1208 Accumulated Depreciation — Office Equipment

1209 Motel Equipment

1210 Accumulated Depreciation — Motel Equipment

1211 Signs

1212 Accumulated Depreciation — Signs

1213 Land Improvements

1214 Accumulated Depreciation — Land Improvements

1215 Heating & Cooling System

1216 Accumulated Depreciation — Heating & Cooling System

1217 Fence

1218 Accumulated Depreciation — Fence

OTHER ASSETS

1301 Ramada Franchise

1302 Escrow Deposit

1303 Utility Deposits

1304 Organization Cost

LIABILITIES

CURRENT LIABILITIES

2100 Accounts Payable — Represents all due and unpaid items otherwise unallocated

2109 State Withholding Tax Payable — Represents Arkansas state withholding tax from employees

2110 Federal Withholding Tax Payable — Represents Federal withholding tax from employees

2111 Accrued F.I.C.A. Taxes Payable — Represents FICA withholding tax from employees

2133 Note Payable — Modern Security Life — Represents 1st mortgage loan on buildings and improvements — current year's portion only

2134 Due Bowens Restaurant — Represents funds collected on behalf of Bowens from motel guest

NON-CURRENT LIABILITIES

2200 Note Payable — Modern Security Life — Represents 1st mortgage loan on building and improvements — all but current year's portion

EQUITY

3000 Capital Stock

3001 Undistributed Taxable Income

3096 Current Earnings (Loss)

INCOME

ROOM—TELEPHONE—MEETING ROOM SALES

4100 Room Sales — Represents revenue received from rental of motel rooms

4101 Meeting Room Sales — Revenue received from rental of meeting room rentals

4102 Telephone Sales — Long Distance — Revenue received from guest long distance calls

MISCELLANEOUS SALES

4200 Telephone Pay Station — Revenue received as commissions on pay stations

4201 Restaurant Rental — Revenue received from restaurant lease

4203 Service Station Rental — Revenue received from service station lease

4204 Sales Tax — Net of sales taxes collected and paid

4205 Bowen Restaurant Credit Card Discounts — Revenue received as discounts on credit cards from sales collected on behalf of Bowens and deducted from their payment

4206 Interest Income — Income from passbook savings and time deposits

4207 Miscellaneous Income — Miscellaneous income from other sources

SALES — OTHER

4300 Game Machine — Revenue received as commission on game machine

4301 Guest Laundry & Valet — Revenue received from guest for laundry & valet service

4302 Magazine Sales — Revenue received from the sale of magazines

4303 Cigarette Machines — Revenue Received as Commission from cigarette machines

4304 Pop Machines — Revenue received from sale of pop

4305 Copy Machine — Revenue received from sale of copies

4306 Candy — Convenience Machines — Revenue received from candy & convenience machines as commissions

EXPENSES

COST OF ROOM SALES

7100 General Manager Bonus — Funds drawn by owners
7101 Night Auditors — Payroll — Funds paid all front desk personnel as salaries
7102 Housekeeper — Payroll — Funds paid housekeeper as salary
7103 Linen Persons — Payroll — Funds paid to maid's helpers who primarily transport soiled linen and clean linens to and from laundry to maid's carts boys as salary
7104 Maids — Payroll — Funds paid all maids as salary
7105 Laundry — Payroll — Funds paid all laundry help as salary
7106 Linen Expense — Cost of all room linens, sheets, pillow cases, towel, bathmats, face towels, etc.
7107 Guest Supplies — Cost of all guest room supplies, paper products, soap, ash trays, etc.
7108 Cleaning Supplies — Cost of all room cleaning supplies, chemicals, sprays, sponges, toilet supplies, etc.
7109 Laundry Supplies — Cost of all supplies used in the laundry, detergent, bleach, spot remover, etc.
7110 Miscellaneous Expense—All room expenses not allocated
7111 Pest Control — Cost of room pest control spraying
7112 Travel Agency Commissions
7113 Uniforms — Cost of laundry and maid's uniforms
7114 General Manager — Payroll — Cost of General Manager Payroll, if any
7115 Bellmen Payroll — Cost of bellmen payroll, if any

COST OF TELEPHONE SERVICE

7200 Cost of Long Distance Service — Long distance charges made by room guest
7201 Switch Board Rental Cost — Cost of switchboard rental
7202 Miscellaneous — Sales tax charge, yellow page advertising, etc.

COST OF OTHER SALES

7300 Guest Laundry & Valet — Cost of providing service
7301 Magazines Expense — Cost of magazines
7302 Pop Machines — Cost of pop supplies
7303 Miscellaneous Expenses — All other unallocated expenses
7304 Copy Machine Expense — Cost of copy machine rental and supplies

GENERAL AND ADMINISTRATIVE EXPENSE

7400 Credit card discounts & bank charges
7402 Dues & subscriptions
7403 Land lease
7404 Miscellaneous
7405 Office supplies
7406 Postage
7407 Professional Services — Cost of CPA's & legal services
7408 Interest expense
7409 Royalty Payments — Cost for Ramada franchise royalty payments
7410 Telephone & Telegraph — Cost of office telephone
7411 Travel — Moving Expense — Cost of airport service, general manager travel, and management moving expense
7412 Employer FICA Expenses & Unemployment Insurance Expenses — Cost of employer portion of FICA expense and premium on unemployment insurance policy
7413 Bad Debts — Uncollected rooms rents and returned checks
7414 Freight & Storage — Freight on all goods shipped to property and any local storage cost
7415 Long & Short — Net account for miscellaneous over & short errors in night auditor's reports
7416 NCR Maintenance Agreement — Cost of agreement on cash register
7417 RINA — Training fees
7418 Computer Services — JDS

ADVERTISING AND PROMOTION

7500 Miscellaneous — Cost of miscellaneous advertising, help wanted ads, etc.
7501 National Advertising Fund—Ramada national advertising program
7502 Newspapers & Magazines — Local high schools and colleges year books, etc.
7503 Billboards — Cost of outdoor advertising along higheays — off premises
7504 On Premises Signs — Cost of large rental signs on premises

REPAIRS AND MAINTENANCE

7600 Contract Labor — Other
7601 Contract Labor — Family (Rob)
7602 Payroll — Family (Jim)
7603 Air Conditioning & Heating — Cost of maintaining and servicing these units including chemical products
7604 Building — Cost of building repairs
7605 Contract Services — Cost of yearly service to air conditioning and heating unit — Mauldins, Inc.
7606 Electrical & Mechanical — Cost of repairs and supplies
7607 Furnishings — Cost of repairs and supplies
7608 Laundry — Cost of repairs and parts
7609 Miscellaneous — All unallocated cost
7610 Painting & Decorating
7611 Plumbing — Cost of repairs and parts
7612 Pool — Cost of repairs, parts, chemicals and supplies, all
7613 T.V. Lease — Cost of T.V. lease from RCA
7614 T.V. Non-Contract — Cost of all T.V. repairs
7615 Payroll — Outside if any
7616 Grounds Maintenance — Lawn & grounds maintenance, supplies, equipment & equipment repairs

UTILITIES

7700 Electricity
7701 Natural Gas
7702 Sewer & Garbage
7703 Water

RESERVATION EXPENSE

7800 Reservation Fees — Net cost of inbound fees less outbound reservation credits
7801 Ramada INFO2000 Terminal — Cost of terminal rental

INSURANCE — TAXES — DEPRECIATION

7900 Workmens Compensation Insurance Policy
7901 General Perils Insurance Policy
7902 Property Taxes
7903 Depreciation Expense
7904 Mortgage Insurance Policy (Modern Security Life)

sector number in which the first record for that month falls. This table is used by all programs to determine the location of the file you desire to access. Refer to Figure 12 for the layout of this table. To initialize a ledger file, load the program GETPUT Figure 31 and place your first month's ledger date in Locations 1-4 and the Sector Address 0001 in Locations 5-8. It will take *basic* approximately 10 minutes to accomplish this. Afterward you may access any sector within the 2037 sectors as part of Ledger file almost instantly. Files 2 and 3 are identical to File 1 since they are copies of 1 made at different times during the processing routines. However, it is not necessary to always copy the entire floppy, only the area worked. See discussion under COPRAN that follows.

Source Documents

There are three basic source documents used for entering all data. They are:

1. **JOURNAL VOUCHER** (Figures 13, 15, 16)
2. **CHECK STUBS OR CHECK COPIES** (Figure 14)
3. **CANCELLED CHECKS** (We all know what these look like)

Journal Voucher — Three types of journal vouchers are used in the General Ledger Package. Figure 13 represents the type used in program GL6. This is a special purpose program which is probably unique to my business. Everyday I have one of the vouchers which, as you can see, contains many entries. Therefore I developed GL6 which generates all of the voucher except the money amount, and my clerk does not have to write in all the data, since it is pre-entered on the voucher. This cuts down on errors at all levels. The second type of voucher is for payroll.(See Figure 16.) It is pre-entered with most of the basic information except the date, voucher number and money amounts. This voucher is entered into the system via program GL1. The data for this voucher comes directly from the Payroll Package in the June Issue of INTERFACE AGE. The third type of voucher is shown in Figure 15. It is simply a blank form used for all types of ledger entries. It is used to make all entries not made on the other vouchers or from check stubs or check copies.

Check Stubs — Check stubs or check copies can be used for the other type of source document. Refer to Figure 14 for a sample of my check stub. We simply code the debit account number to the check stub. The credit account number for all check stubs is the General Checking Account 1110, hence we do not code it. If there is more than one credit account involved, we code all of them with their respective money amounts.

Cancelled Checks — Cancelled checks are used in program GL4 in reconciling the bank statement. See discussion of GL4 that follows.

GENERAL LEDGER PROGRAMS

Fourteen BASIC programs make up the General Ledger Package. These programs are as follows:

•GLMENU	Display all General Ledger Programs and prompts the operator as to the flow of processing.
•GL1	Enter Check Transactions for Account 1110
•GL2	Run Ledger Transactions by: A. Check No. - Voucher No. B. Account No.
•GL3	Merge BANKBKUP with ledger and create new BANKCURR
•GL4	Enter checks cashed and tag BANKCURR
•GL5	Run Bank Statement for Account No. 1110
•GL6	Enter Daily Room Revenue Journal Vouchers
•GL7	Run Monthly or YTD Budget — Monthly or YTD Analysis
•COPRAN	Copy Files

- •GETPUT Make Master Changes
- •SORTGL Sort General Ledger Files
- •COPCON Copy Budget File to Budget History File
- •CHART Loads General Ledger Chart of Accounts in program format for listing or updating
- •GENPRO List the procedures for running the General Ledger Package of Programs

Program GLMENU (Figure 23b) — This is a system operator prompt and boot-up program which boots up the desired program selected by the operator. All programs in the system in turn boot up this program upon reaching end of job.

Program GL1 (Figure 24) — This program enters and edits the information from the source documents in Figures 14, 15 and 16. It edits the information for obvious errors, prints a hard copy on the line printer, and verifies that the debits equal credits. You may correct an individual line or re-enter the entire document. If you make a mistake in the middle of a line, simply hit / or return. The program will let you re-enter the line. Should the debits be greater or less than the credits, you may examine the hard copy print out, select a line number, and re-enter one line over again. You can continue to re-enter one line until the debits equal the credits. You may enter un-balanced entries if you desire. This is nice for correcting a disc error without having to delete and re-enter much data. It will happen. You will get data on the disc and the debits will not equal the credits. Simply make a one-sided entry for the difference.

You can also use this program to enter new account headers. Give them -0- money amounts. I used it initially to enter my beginning ledger account header/balance forwards.

The pause after the first document has been entered is the computer locating the file in question and going to the EOF record in the file:

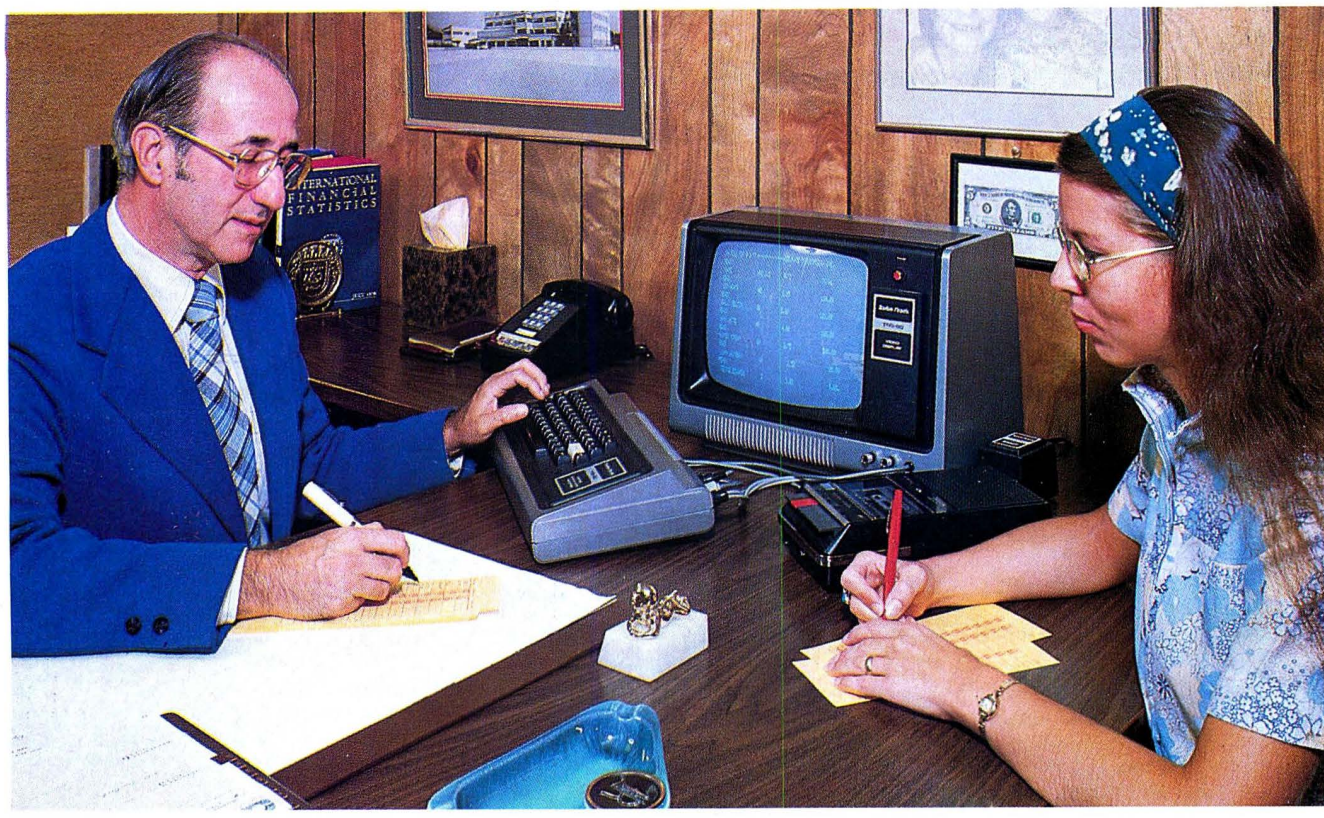
Program GL2 (Figure 25) — This program produces: a) The Check/Voucher Register Figure 23a; b) The General Ledger Figure 19; c) The Balance Sheet Figure 20; d) It can also be used to tab an account number for a month-to-date total, i.e. the bank account.

You can run the general ledger with or without producing new balances for next month. This is nice when you wish to go back and re-run an old month's report for some reason. Maybe you need an extra copy. You can also run the ledger with or without producing the budget file. This is nice for the same reasons. Or perhaps you need to reconstruct the budget for an old month. You can run the ledger without new balances but produce the budget file.

One thing you can't do. You cannot tab the Ledger Detail file. When you request TAB, you get the new balances for next month's ledger. The answers will be the same and the time consumed will be less, but it would be nice to TAB the Check/Voucher Register without having to list it.

Remember, when the program asks for a period ending date, that's the file the computer will always access.

Program GL3 (Figure 26) — This program is used to update the Bank Reconciliation File for Account 1110 (the general checking account). It merges the balance forward, checks and vouchers for Account 1110 in this month's ledger file with the checks outstanding in last month's BANKCURR (this month's BANKBKUP file) and produces this month's BANKCURR file. Refer to the flow chart in Figure 4, Step 8 for a picture of the merge. The result of the merge is a file called BANKCURR which contains this month's transactions to Account 1110 and last month's outstanding checks. One caution — before run-



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ning this program, copy BANKCURR to BANKBKUP or you will be merging the wrong data and destroying the data you should have been merging. The program cautions you before running it.

Program GL4 (Figure 26a) — This program tags the check transactions contained in BANKCURR after the merge above, and changes their type code from a 2 to a 3 indicating they have cleared the bank (cashed). When entering the data for this program, the cancelled checks are the source document. Enter the check number and get the check amount from the MICR (magnetic ink field) amount in the lower right hand corner of the check coded by the bank. This will assure you that the bank cleared the check for the same amount you have entered in your ledger. The program compares both the check number and the amount entered to the same data in your BANKCURR file. You may have even entered it yourself wrongly and the bank may be correct. Anyway, it gives you a double check and that's what accounting is all about. Now the cancelled checks do not have to be in numerical order. I enter them just as they come out of the bank envelope. The program contains its *on-sort* routine to sort the checks to match them to the BANKCURR file. Any unmatched items are printed on the terminal and tagged as cashed anyway. My experience has been that I enter it wrongly on the terminal more often than the bank makes an error. Doublecheck all errors on the terminal to be sure who is right.

Program GL5 (Figure 27) — This program lists the BANKCURR file in a bank reconciliation format. This listing is used to verify that the ledger account 1110 is in balance with the bank statement.

Program GL6 (Figure 28) — This program is the special purpose program which enters the special journal vouchers discussed earlier and shown in Figure 13. Since I have a stack of them every month this program was developed to take the drudgery out of entering this pile of data and increase the accuracy of the data.

Program GL7 (Figure 29) — This program produces the monthly and Y.T.D. budgets and the monthly and Y.T.D. statistical analysis as shown in Figures 20, 21, 22, and 23. It uses a set of budget figures provided by the user and contained in a set of data statements. The figures represent the user's estimated monthly guestimates as to what will be produced or spent in a particular ledger account during an average month for the duration of the next 12 months. In short, they are 12 monthly averages. The BUDGET file which is produced by GL2 and written on the end of the ledger floppy each time GL2 is run contains only the monthly actual figures which were extracted from the ledger. The ledger balance forwards are used for the Y.T.D. actual figures. Therefore this program actually works with two different data files, depending on whether you are running the monthly or Y.T.D. run. The same holds true for the statistical reports. The statistical reports extend the budget one step further and break down all the figures on a per-unit basis. In my case it is motel rooms occupied and available whether occupied or not. You can modify this portion to suit your own needs.

Program COPRAN (Figure 30) — This is a general purpose utility program used throughout the general ledger package. It is used for transferring data from one file to the next, for copying files, for copying portions of files, etc. This version is almost the same as that version included with the Payroll Package in the June issue of INTERFACE AGE. However, this version has been modified to work with the program GLMENU and to support the general ledger package of programs.

Program GETPUT (Figure 31) — This is another utility program used for changing data in any of the general ledger random data files. You can insert or delete from 1 to 128 characters to any sector. It dumps

1. LEDGER CURRENT
2. LEDGER BACKUP — BEFORE
3. LEDGER BACKUP — AFTER
4. BUDGET
5. BANK CURRENT
6. BANK BACKUP
7. BANK SAVE
8. BUDGER HISTORY

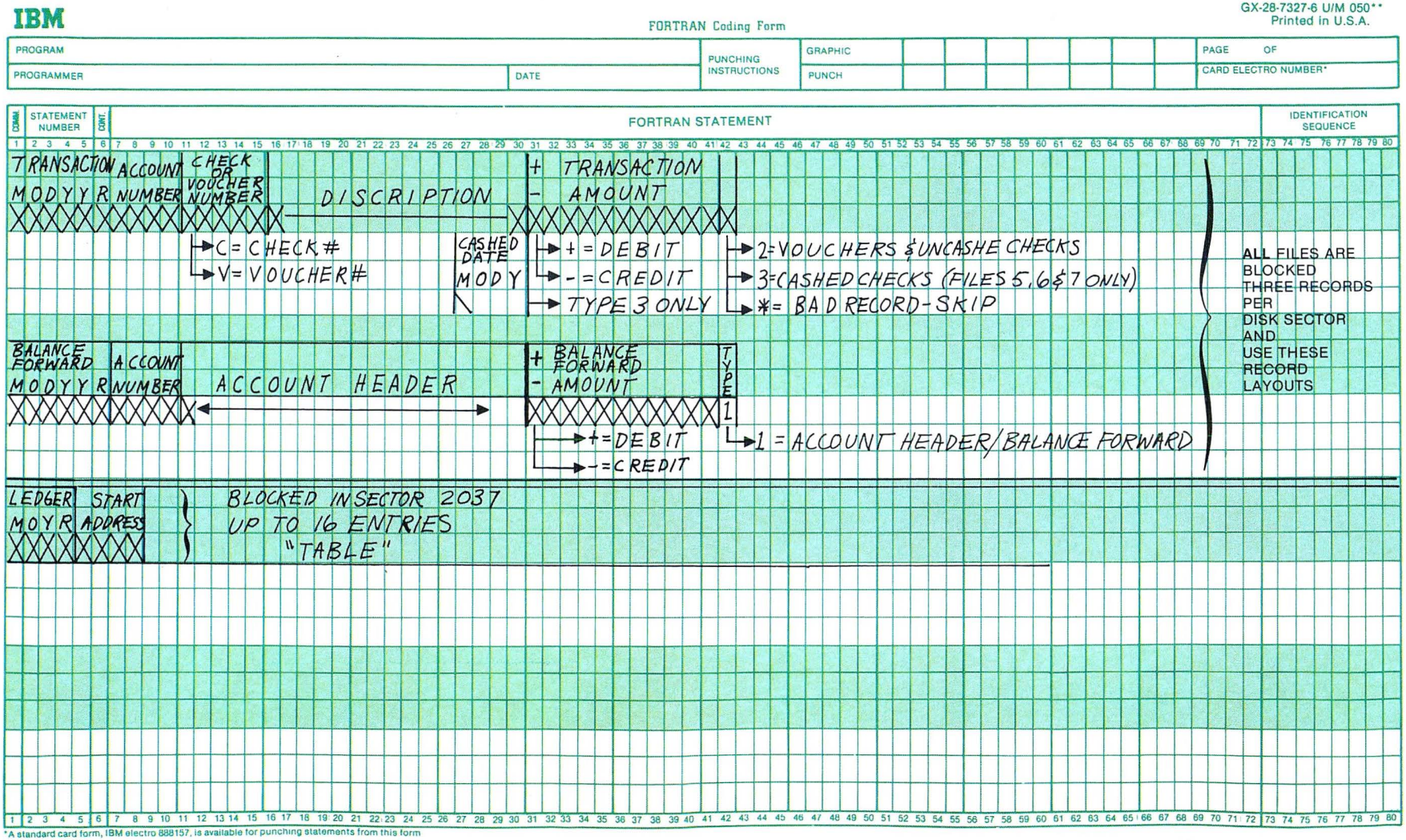
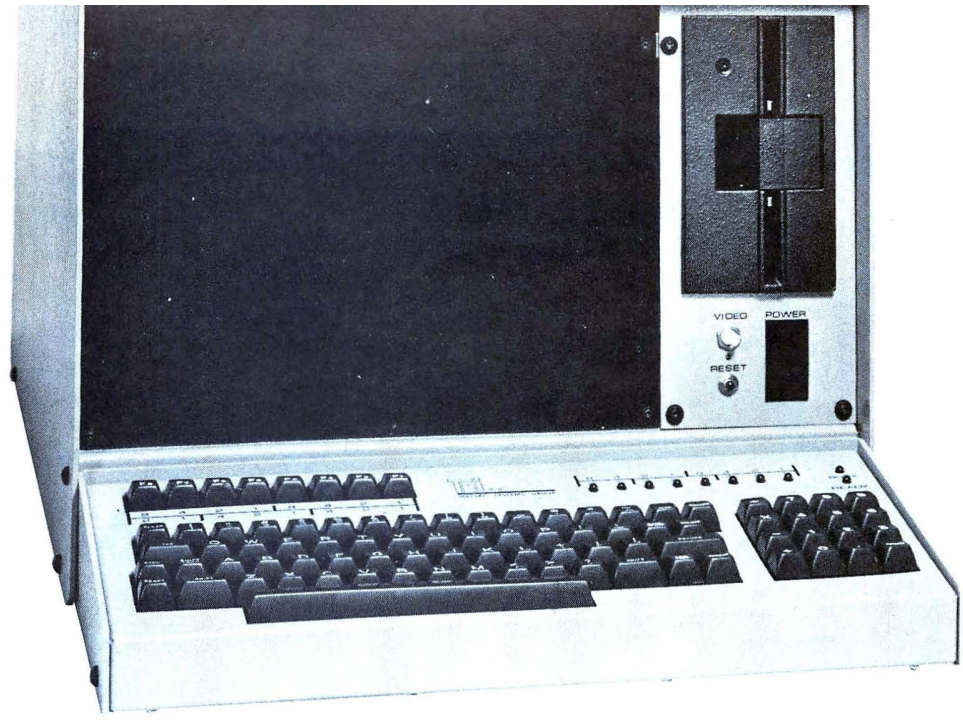


Figure 12. General Ledger Disk Record Layout



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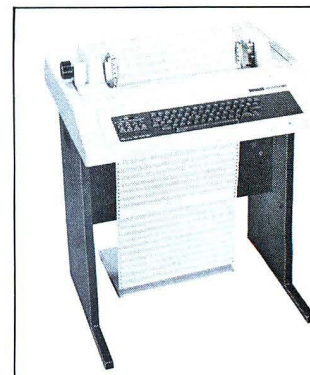

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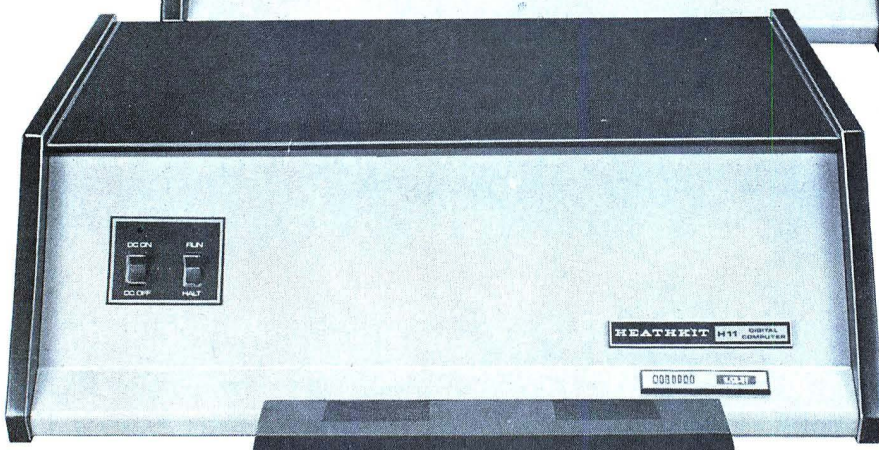

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STEP 1
PROGRAM "GL6"

SAMPLE OF DAILY DEPOSIT VOUCHER
AMOUNTS TAKEN FROM
NIGHT AUDITOR'S REPORT

PROGRAM "GL6" IS USED EXCLUSIVELY FOR ENTERING THIS TYPE OF TRANSACTION. IT SUPPLIES ALL THE DATA EXCEPT THE AMOUNT. IF NO AMOUNT FOR AN ITEM, ENTER "N."

2-DIGIT DAY
2-DIGIT MONTH

JOURNAL VOUCHER

DATE MO DAY YR XX / XX / XX

VOUCHER NO. XX XX

ASSIGN BY COMPUTER STARTING AT DATE ENTERED

DESCRIPTION

MO DAY YR
DAILY DEPOSIT XX / XX / XX

ACCOUNT #	DEBITS	AMOUNT
1110	Bank Deposit	
1130	Accounts Receivable	
1129	City Ledger	
7400	Cr. Card Discount	
7404	Short	
	TOTAL	

ACCOUNT #	CREDITS	AMOUNT
4100	Room Rent	
4204	Tax	
4102	Telephone	
2134	Due Bowens	
4302	Newsstand	
4101	Meeting Room	
1130	Accounts Rec.	
1129	Cr. Card Discounts	
1129	City Ledger	
4301	Valet	
7404	Long	
	TOTAL	

Figure 13. Daily Deposit Voucher

the sector on the terminal and identifies each position, lets you enter your new data, then writes out the new data and displays them on the terminal.

This program also appeared in the Payroll Package in the June issue of INTERFACE AGE. However, like all programs in the package, it works in conjunction with GLMENU to service the whole general ledger package.

Program SORTGL (Figure 32) — This program does all the sorting necessary to produce all the reports for the general ledger package. It will sort up to 1750 blocked records in a 64K machine. It is a sort-in-place program. That is, the sorted file will end up in exactly the same place as it originated. The *sort* always goes from drive 1 to drive 0. If you only have one disc drive, then you have many modifications to make. Not only to this program but to the whole package. The *sort* is monitored on the terminal and a hard copy record of the *sort* is printed on the line printer. The hard copy gives the name of the *sort,* the date, the locations of the files, and where the EOF trailer record is written. This is very useful for copying portions of the files for back-up purposes.

Program COPCON (Figure 33) — A little simple utility program used for copying the BUDGET file to the Budget History File. I'm a firm believer in history files. It cost very little to keep the data once they are developed. And who knows what kind of information I can develop two or three years down the road from such hard-to-come-by information. It also serves as a very good means of backup.

Program CHART (Figure 34) — Chart is a general ledger Chart of Accounts maintained on the disc in a program format. This program format makes for a simple method of maintaining and updating the Chart of Accounts.

Program GENPRO (Figure 35) — This is the system boot program. I've included it so you may modify it to suit your own needs and to add your own programs to it. It makes running and maintaining your general ledger system a snap.

THE GENERAL LEDGER RUN PROCEDURES

The run procedures are just straight forward as Figure 1 indicates. I always have them in front of me when I attempt any job. It's too easy to forget a step. Forget a step and there goes much valuable time and sometimes much data. So stick to the procedures and you will have fewer problems. You will notice I am a stickler for backing up files. That's because I've learned the hard way. Better too much back-up than not enough. I back up my files both before and after running the ledger. Then I can completely reconstruct at any point in time if things bomb out. Mine have. Let's not talk about that. Use the flow charts, Figures 2-11, along with the procedures until you have a visual picture of just what's taking place. Until you know just how all the program and jobs dovetail together, continue to use the procedures.

Summary of Procedure Steps

Procedure steps consist of the following monthly and year end procedures;

Figure 1. General Ledger Procedures

MONTHLY PROCEDURE

PROGRAM	STEP	PROCEDURE
GLMENU	0.	Display all general ledger programs and prompts the operator as to the flow of processing. In addition this program boots up the desired program selected by the operator.
GL6	1.	Enter daily room revenue journal vouchers
GL1	2.	Enter check transactions for account number 1110 — the

Figure 1. cont.

		general checking account
GL1	3.	Enter journal vouchers for: A. Other income (concessions, rent, etc.) B. Bank charges (returned checks, BAC & MC, etc.) C. Add new account headers (zero money amounts)
COPRAN	4.	Copy 'ledger' current to 'ledger' backup-before
SORTGL	5.	Sort on check number/voucher number
GL2	6.	Run check/voucher register — verify debits = credits
COPRAN	7.	Copy 'BANKCURR' to 'BANKBKUP'
GL3	8.	Merge-drive 1 BANKBKUP- with -drive 0 ledger account 1110- and cut new -drive 1 BANKCURR-
COPRAN	9.	Copy 'BANKCURR' (0201-0400) to 'BANKSAVE' (0401-0600)
GL4	10.	Enter check number and amount from canceled checks and tag checks cashed in 'BANKCURR' (Enter 'T' to terminate input)
GL5 COPRAN	11.	Run bank statement for account 1110 and balance to bank. Make any corrections to 'ledger' & copy to 'ledger' backup-before
SORTGL	12.	Sort 'ledger' on acct#/check#/ voucher#
GL2	13.	Run general journal. Verify bank balances. Look over run for errors. Correct any errors and re-run if necessary
GL2	14.	Run balance sheet & operating statement
GL7	15.	Run monthly budget
GL7	16.	Run Y.T.D. budget
GL7	17.	Run monthly statistical report
GL7	18.	Run Y.T.D. statistical report
COPRAN	19.	Copy 'ledger' current to 'ledger' backup-after
COPCON	20.	Copy 'budget' to 'BGTMOYR'

YEAR END PROCEDURE

GL2	1.	After all entries and runs for the year have been made, request closing entries, place new floppy on drive 0 and run general journal with no transactions. All the proper accounts will be zeroed out. Manually add current earnings total (account #3096) to undistributed taxable income (account #3001) to place the balance sheet back in balance.
	2.	Enter new budget figures into data tables in program 'GL7'.
	3.	Make journal entry to establish new current liabilities—notes payable account 2133.
	4.	Accrue accounts payable at year end and journalize. Take out of accounts payable as paid.

Procedure Step Flow Diagrams

The following flow diagrams, beginning on page 41, define each procedure step:

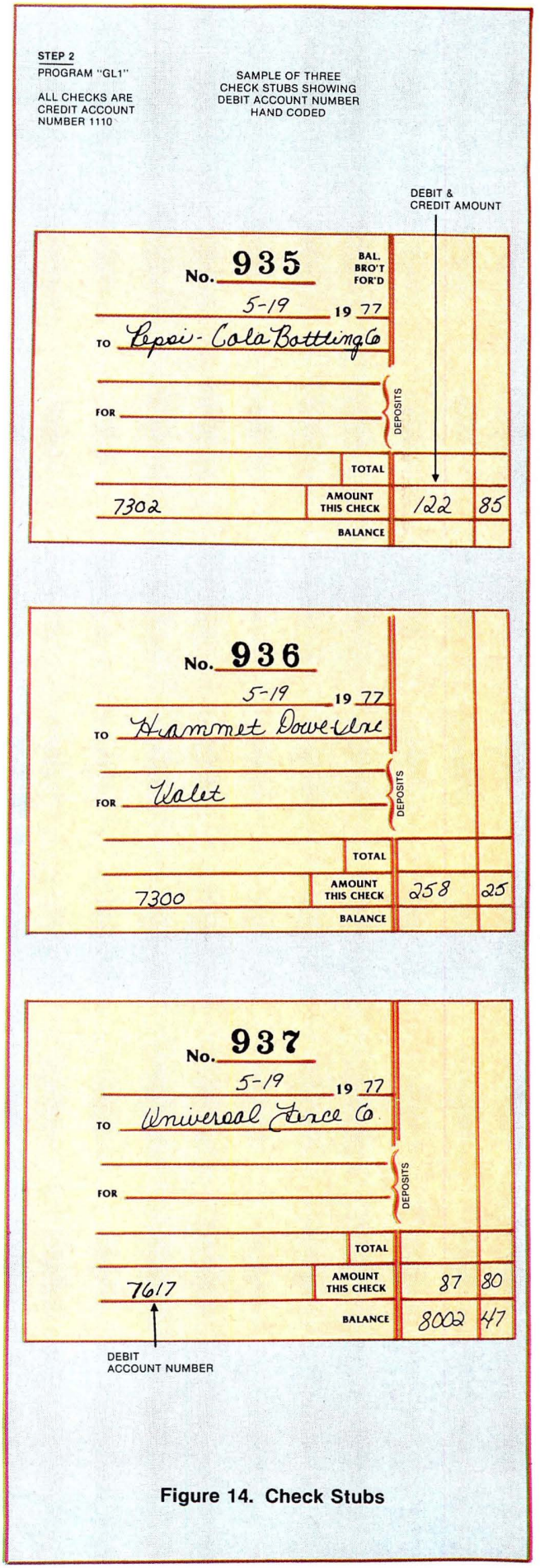


Figure 14. Check Stubs

STEP 3
PROGRAM "GL1"

SAMPLE OF STANDARD JOURNAL VOUCHER
USED FOR ALL OTHER LEDGER ENTRIES
EXCEPT CHECKS

USER MUST COMPLETE & ENTER ALL DATA

[USING STANDARD CHECK STUBS OR CHECK COPIES, ENTER THE SAME TYPE OF DATA FOR CHECKS, EXCEPT REQUEST 'CHECKS' AND USE CHECK NUMBER.]

2 DIGITS ABOVE 31

JOURNAL VOUCHER

2-DIGIT MONTH

DATE MO DAY YR XX / XX / XX

VOUCHER NO. XX XX

DESCRIPTION

ACCOUNT #	DEBITS	AMOUNT	ACCOUNT #	CREDITS	AMOUNT
	TOTAL			TOTAL	

Figure 15. Standard Journal Voucher

SAMPLE OF BLANK PAYROLL VOUCHER
AMOUNTS TAKEN FROM
WEEKLY OR MONTHLY
PAYROLL LISTING

STEP 3
PROGRAM "GL1"

2-DIGIT DAY NUMBER ABOVE 31

JOURNAL VOUCHER

2-DIGIT MONTH

DATE MO DAY YR XX / XX / XX

VOUCHER NO. XX XX

DESCRIPTION

PAY PERIOD MO DAY YR XX / XX / XX

ACCOUNT #	DEBITS	AMOUNT	ACCOUNT #	CREDITS	AMOUNT
7101	Clerks & Night Auditor		1111	Payroll Per.	
7102	Housekeeper		2109	SIT	
7103	Linen Boys		2110	FIT	
7104	Maids		2111	FICA	
7105	Laundry				
7602	Maintenance				
7100	Gen. Managers				
	TOTAL			TOTAL	

Figure 16. Payroll Voucher

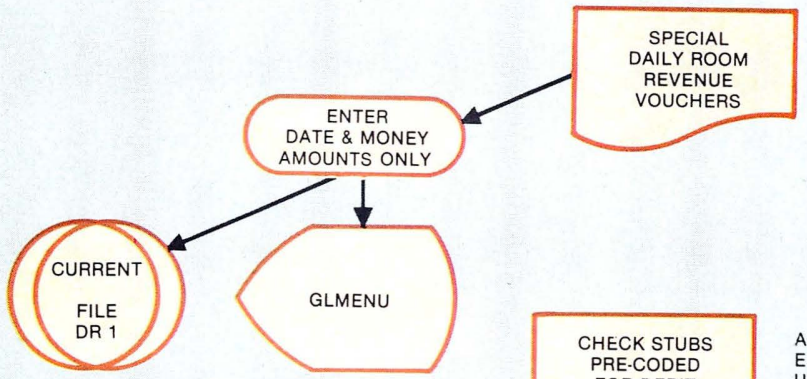
MONTHLY

STEP 0 — **BOOT UP "GLMENU" AND PROCEED**

STEP 1

PROGRAM "GL6"

CURRENT GENERAL "LEDGER" FILE DR 1



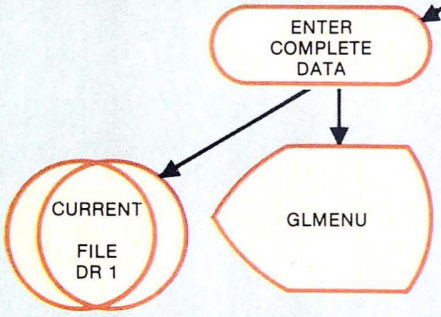
CHECK STUBS PRE-CODED FOR DEBIT ENTRIES

ALL CREDIT ENTRIES WILL USUALLY BE ACCOUNT 1110

STEP 2

PROGRAM "GL1"

CURRENT GENERAL "LEDGER" FILE DR 1



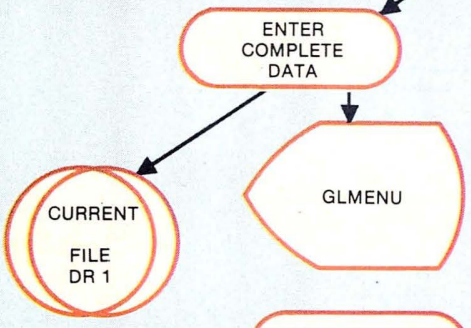
ALL OTHER LEDGER ENTRIES FROM REGULAR JOURNAL VOUCHERS

ALL CREDITS & DEBITS COMPLETELY CODED

STEP 3

PROGRAM "GL1"

CURRENT GENERAL "LEDGER" FILE DR 1

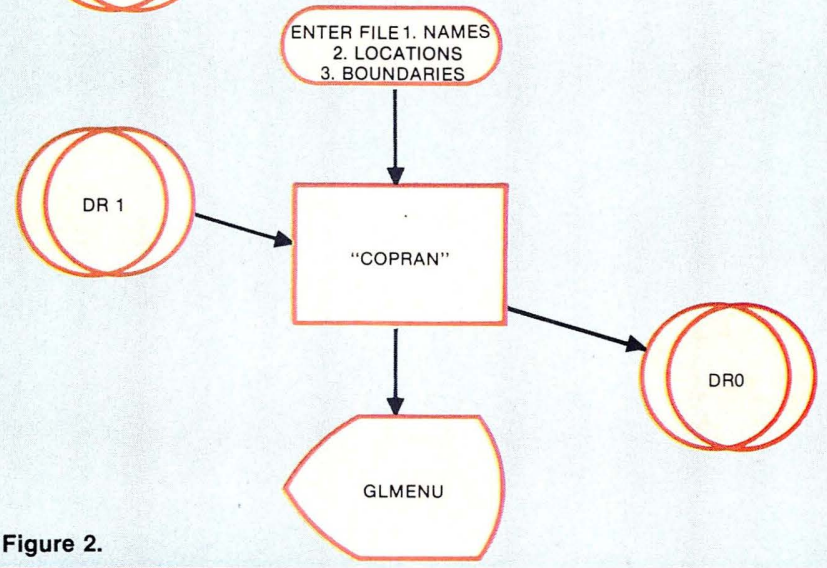


STEP 4

PROGRAM "COPRAN"

CURRENT GENERAL "LEDGER" FILE

REPEAT THIS STEP FOR RECORD #2037



GENERAL "LEDGER" BACK-UP BEFORE PROCESSING

Figure 2.

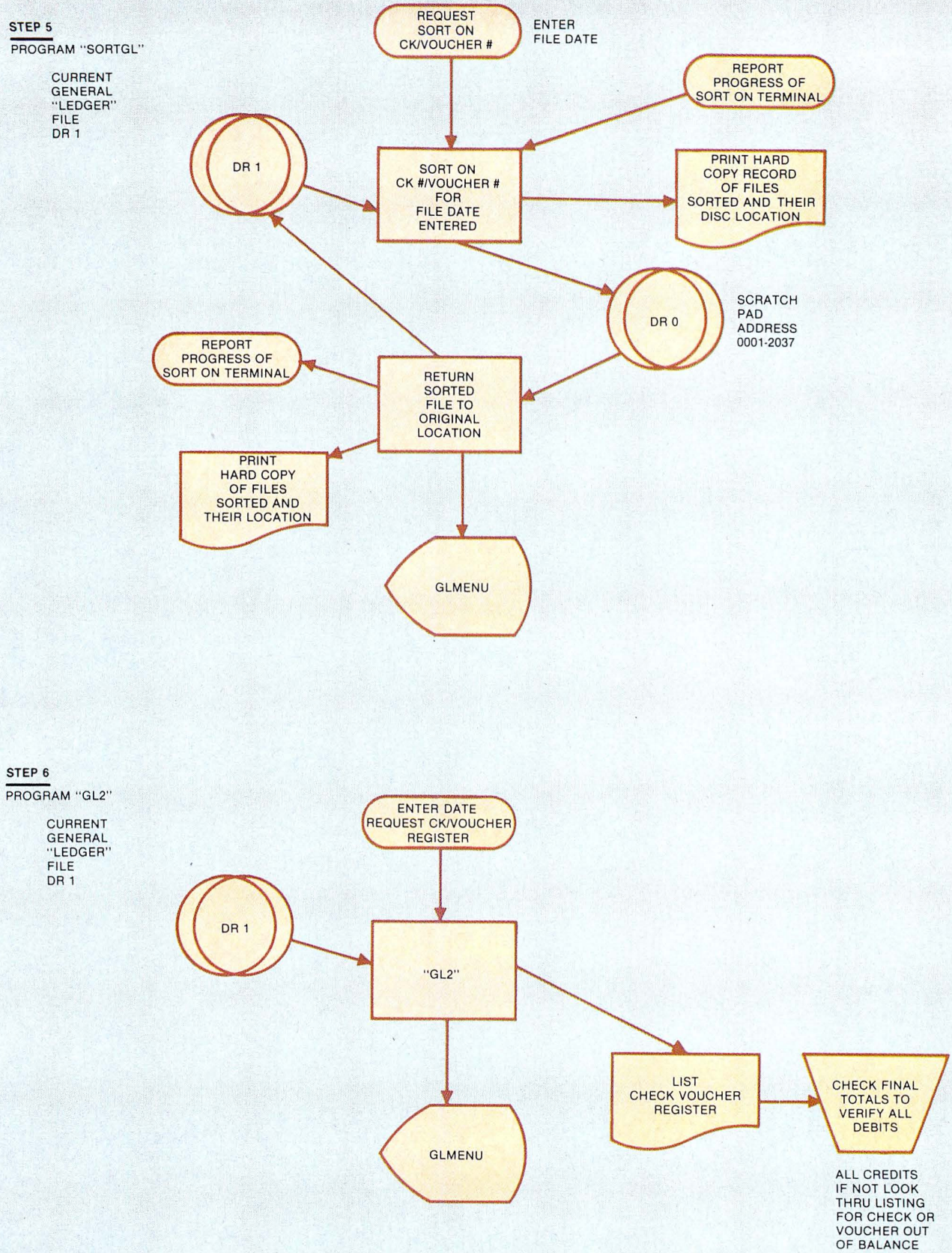
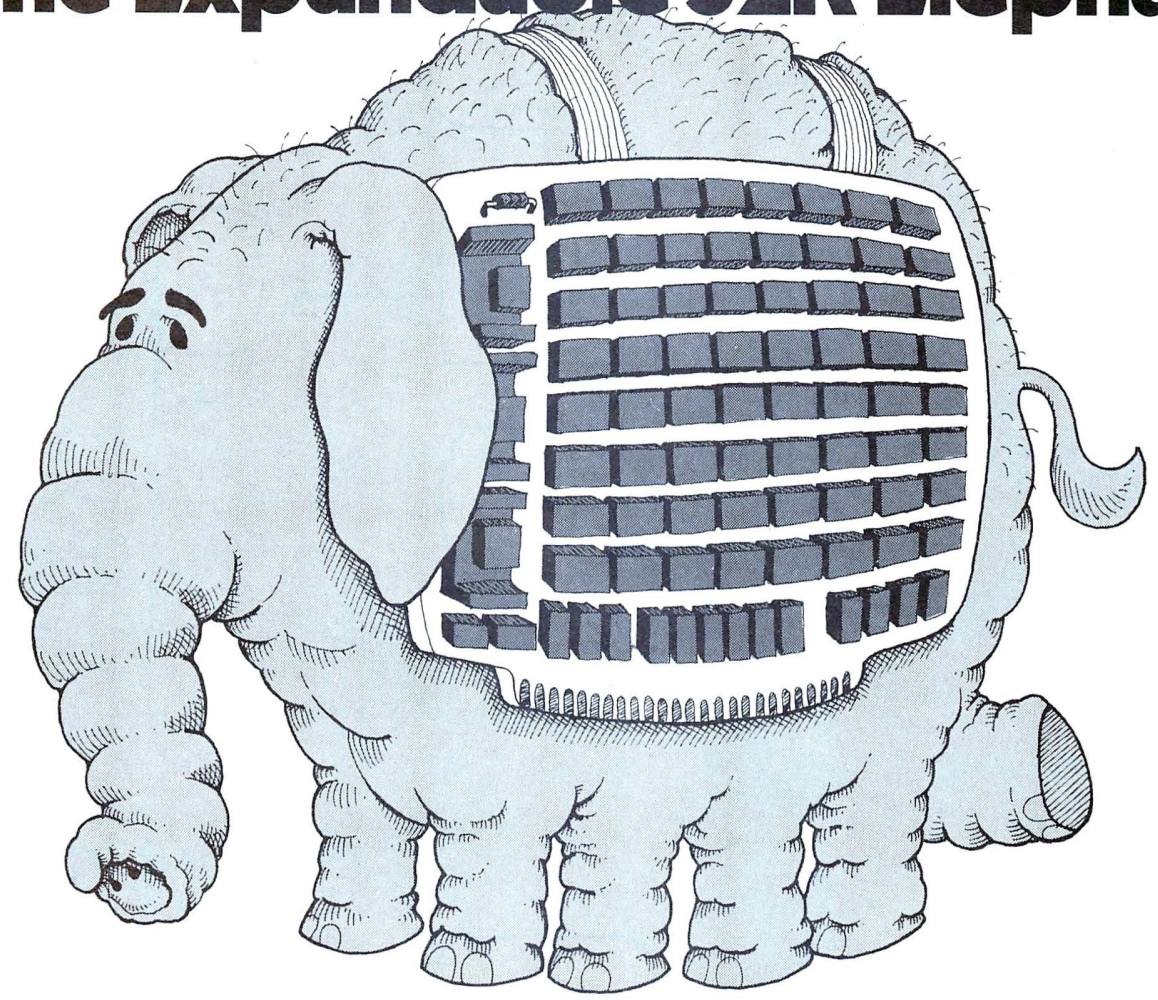

STEP 5
PROGRAM "SORTGL"
CURRENT GENERAL "LEDGER" FILE DR 1
REQUEST SORT ON CK/VOUCHER #
ENTER FILE DATE
REPORT PROGRESS OF SORT ON TERMINAL
DR 1
SORT ON CK #/VOUCHER # FOR FILE DATE ENTERED
PRINT HARD COPY RECORD OF FILES SORTED AND THEIR DISC LOCATION
DR 0
SCRATCH PAD ADDRESS 0001-2037
REPORT PROGRESS OF SORT ON TERMINAL
RETURN SORTED FILE TO ORIGINAL LOCATION
PRINT HARD COPY OF FILES SORTED AND THEIR LOCATION
GLMENU
STEP 6
PROGRAM "GL2"
CURRENT GENERAL "LEDGER" FILE DR 1
ENTER DATE REQUEST CK/VOUCHER REGISTER
DR 1
"GL2"
LIST CHECK VOUCHER REGISTER
CHECK FINAL TOTALS TO VERIFY ALL DEBITS
GLMENU
ALL CREDITS IF NOT LOOK THRU LISTING FOR CHECK OR VOUCHER OUT OF BALANCE

Figure 3.

ARTEC Introduces
The Expandable 32K Elephant

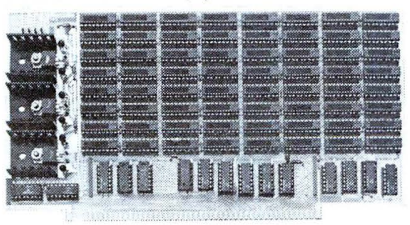


The 8K-32K Expandable Memory That Grows With Your System

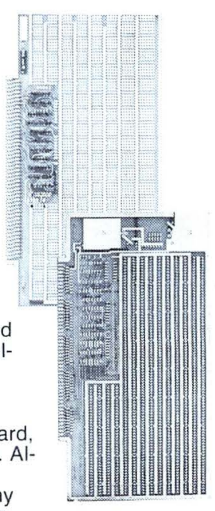
Now, for the first time, you can have a reliable true static memory that will grow with your system. Start with the board and 8K memory. Then add on one, two or three 8K increments of memory up to 32K. 250 ns access time. The Artec 32K Expandable Memory allows you plenty of room for memory and all necessary support hardware.

For five years Artec craftsmanship and reliability has been proven in tough industrial use. Now, you too can enjoy breadboards and memories that will work time after time. Boards like the GP 100 and the wire wrap WW-100. Send for an Artec Board, your order will be sent the same day as received.

Board & 8K of memory—$290.00
8K add on kits—$255.00 ea.
Full 32K board—$1,055.00



GP-100—$20.00
Maximum design versatility along with standard address decoding and buffering for S—100 systems. Room for 32 uncommitted 16 pin IC's, 5 bus buffer & decoding chips, 1 DIP address select switch, a 5 volt regulator and more. High quality FR4 epoxy. All holes plated through. Reflowed solder circuitry.



WW-100—$20.00
A wire wrap breadboard, similar to the GP 100. Allows wirewrap of all sizes of sockets in any combination. An extra regulator position for multiple voltage applications. Contact finger pads arranged for easy pin insertion.

TO ORDER: Use your Mastercharge or BankAmericard. Or just send along a money order. Your order will get same day service.

FOR MORE INFORMATION: For more information about these or any of Artec's complete line of circuit boards or for either industrial or personal use, please call or write. A catalogue will gladly be sent.

Please send me:
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☐ I've enclosed a money order.
Bill my ☐ Mastercharge
☐ BankAmericard No. _____
Name _____
Address _____
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10% discount for students & computer club members.

"Wescon Booth Number 215"

ARTEC ELECTRONICS, INC.

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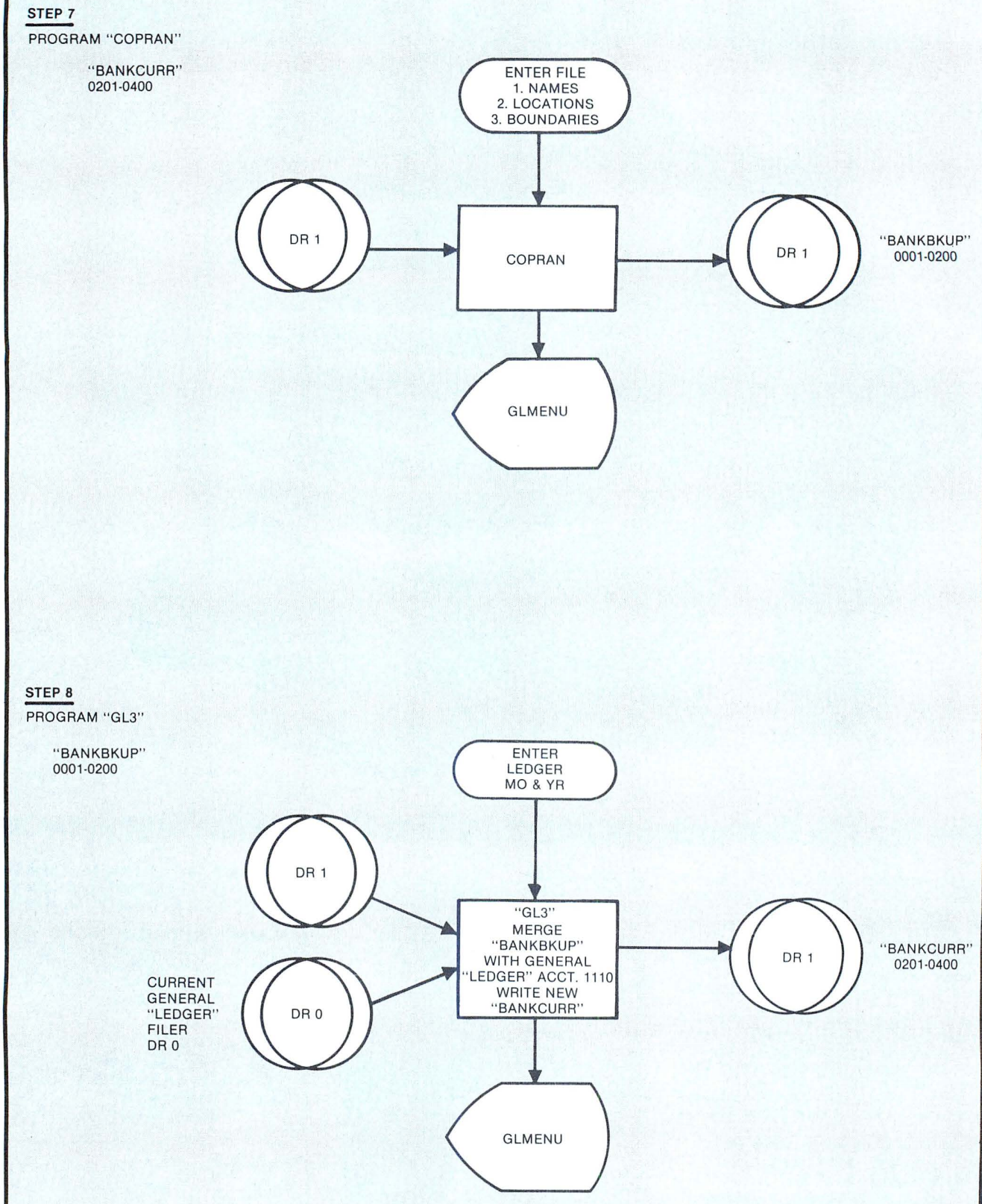
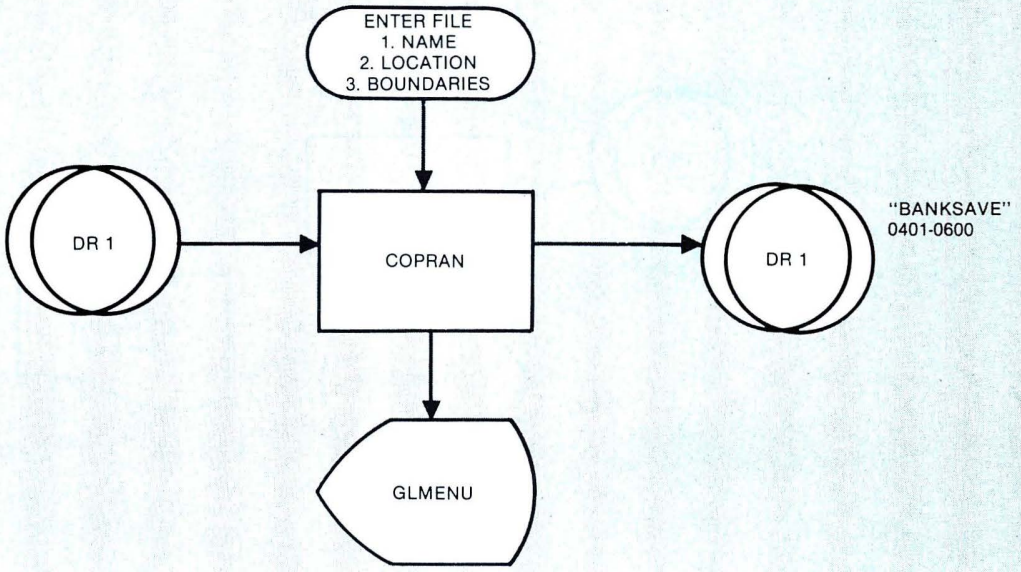

STEP 7
PROGRAM "COPRAN"
"BANKCURR"
0201-0400
ENTER FILE
1. NAMES
2. LOCATIONS
3. BOUNDARIES
DR 1
COPRAN
DR 1
"BANKBKUP"
0001-0200
GLMENU
STEP 8
PROGRAM "GL3"
"BANKBKUP"
0001-0200
ENTER
LEDGER
MO & YR
DR 1
"GL3"
MERGE
"BANKBKUP"
WITH GENERAL
"LEDGER" ACCT. 1110
WRITE NEW
"BANKCURR"
DR 1
"BANKCURR"
0201-0400
CURRENT
GENERAL
"LEDGER"
FILER
DR 0
DR 0
GLMENU

Figure 4.

STEP 9

PROGRAM "COPRAN"

"BANKCURR"
0201-0400



STEP10

PROGRAM "GL4"

"BANKCURR"

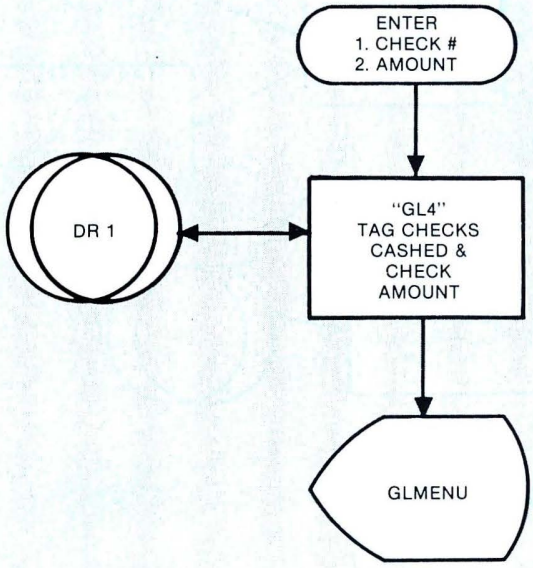


Figure 5.

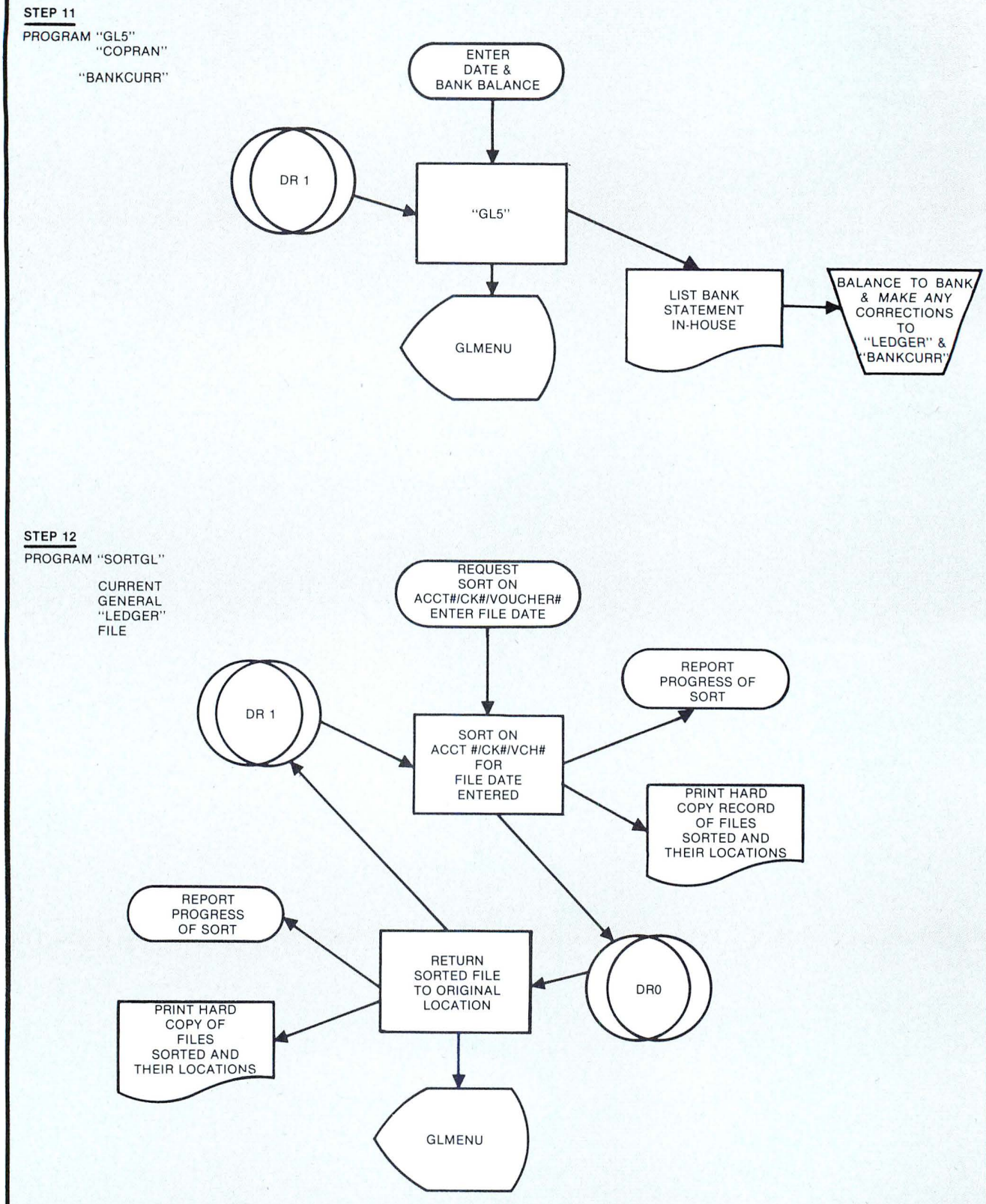

STEP 11
PROGRAM "GL5"
"COPRAN"
"BANKCURR"
ENTER
DATE &
BANK BALANCE
DR 1
"GL5"
GLMENU
LIST BANK
STATEMENT
IN-HOUSE
BALANCE TO BANK
& MAKE ANY
CORRECTIONS
TO
"LEDGER" &
"BANKCURR"
STEP 12
PROGRAM "SORTGL"
CURRENT
GENERAL
"LEDGER"
FILE
REQUEST
SORT ON
ACCT#/CK#/VOUCHER#
ENTER FILE DATE
DR 1
SORT ON
ACCT #/CK#/VCH#
FOR
FILE DATE
ENTERED
REPORT
PROGRESS OF
SORT
PRINT HARD
COPY RECORD
OF FILES
SORTED AND
THEIR LOCATIONS
REPORT
PROGRESS
OF SORT
RETURN
SORTED FILE
TO ORIGINAL
LOCATION
DR0
PRINT HARD
COPY OF
FILES
SORTED AND
THEIR LOCATIONS
GLMENU

Figure 6.

The complete $655 line printer.

It's ready to plug in, has an 80-column format, a remarkable MTBF and is 14 times faster than a teletype!

Breaking the hardcopy barrier

It's finally happened! The Axiom EX-800 provides full performance hardcopy at a price compatible with today's low cost micros. This little 80-column machine zips along at 160 characters per second (14 times faster than a teletype)—at a breakthrough single quantity price of $655 for a complete printer.

When we say complete we mean it

The EX-800 is a stand-alone unit with case, power supply, 96 character ASCII generator and interface, paper roll holder, infra-red low paper detector, bell, and multi-line asynchronous input buffer. You won't find these standard features on any other printer, regardless of price!

Our only option

Our printer is so complete, that we offer only one option. A serial interface (RS 232C or current loop) good for 16 baud rates from 50 to 19,200 and thoughtfully provided with a switch for either Centronics or Tally compatibility. Might we call it a Tally-whacker? At $85.00 it certainly should be!

Built-in LSI microprocessor

The heart of the EX-800 is a printed circuit card, containing a custom LSI chip made by Intel to Axiom specifications, which controls all printer functions. Microprocessor power means flexibility. Such as the built-in self test routine and variable character size. It also means reliability. Several industry surveys have shown LSI to be many times more reliable than equivalent conventional circuitry.

The advantages of electrosensitive printing

The EX-800 can print 80, 40, or 20 characters across the five inch wide electrosensitive paper. Under software control, single characters or words may be printed larger for emphasis. The permanence of the hardcopy is archival, because once the aluminum coating has been removed, there is no way to put it back. It's unaffected by sunlight, moisture or heat. Although the printer doesn't provide multiple copies, excellent quality photocopies can be made from the high contrast printout. Also, the paper is inexpensive and readily available, costing about 1¢ for an 8½ x 11" equivalent.

Light, small, quiet, reliable, and versatile

Our EX-800 weighs in at 12 pounds, is just 9½ inches wide, 4 inches high, and 11 inches deep, and is delightfully quiet which makes it ideal for office and other low noise environments. The simple print mechanism is virtually maintenance free. In fact, tests show an incredible MTBF, many times greater than impact printers. This versatile printer is the ideal mate for micros, minis, CRTs, instruments and systems.

THIS LIFE-SIZE SAMPLE SHOWS THE 80-COLUMN PRINTOUT FROM AXIOM'S EX-800 PRINTER
There are 3 character sizes (upper and lower case) which can be MIXED.
This can have the same effect as UNDERLINING or changing COLOR.

Just unbox and plug it in

That's all you have to do to the Axiom EX-800 — apart from pay for it, and at $655 that's almost a pleasure.

Send to: AXIOM
5932 San Fernando Rd.,
Glendale, CA 91202

- ☐ Urgent. Please phone me at ext ____
- ☐ Have rep contact me
- ☐ I'd like to have a demonstration
- ☐ Send lit including sample of printout

Name_____
Company_____
Dept_____
Address_____
City_____ State_____
Zip_____ Telephone_____

AXIOM CORPORATION
5932 San Fernando Rd., Glendale, CA 91202 • (213) 245-9244 • TWX 910-497-2283

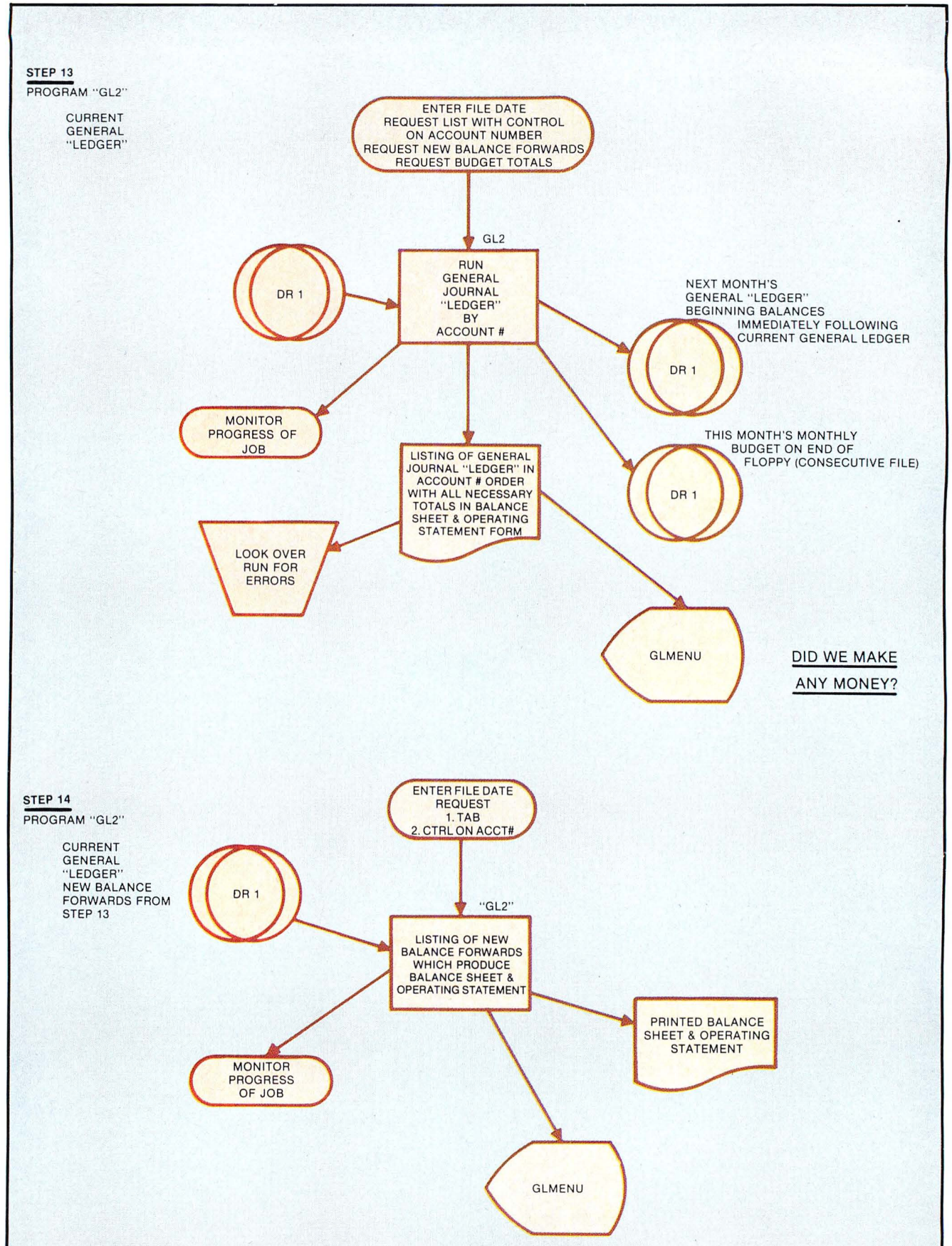
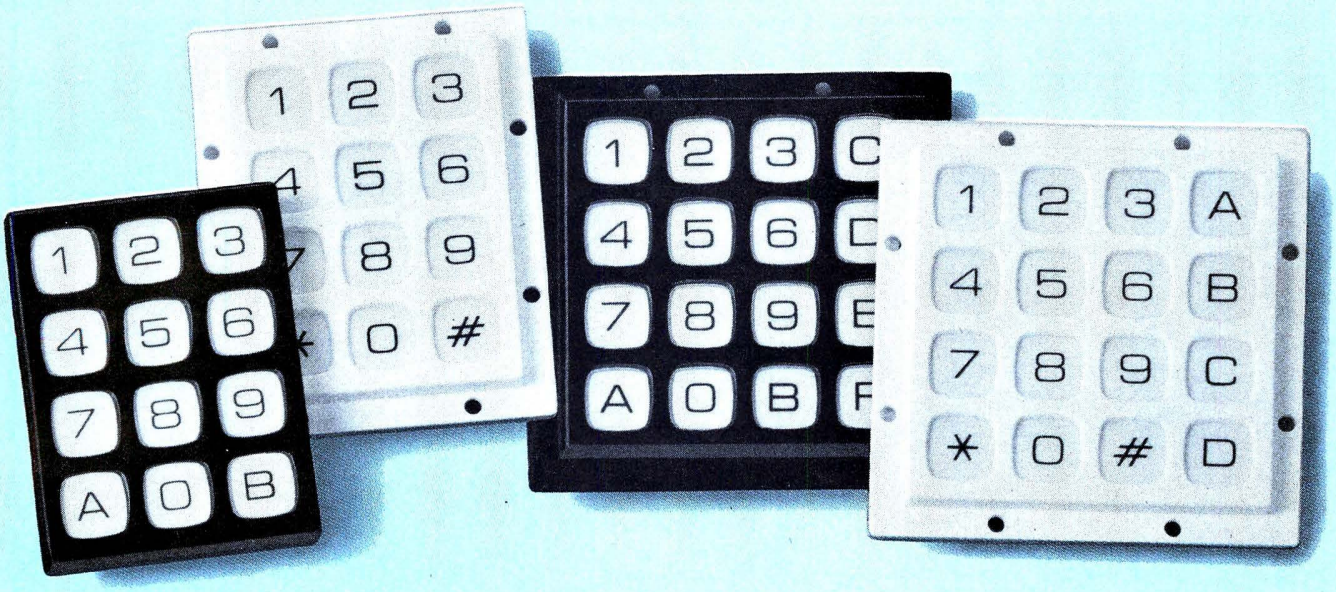

STEP 13
PROGRAM "GL2"
CURRENT GENERAL "LEDGER"
ENTER FILE DATE
REQUEST LIST WITH CONTROL ON ACCOUNT NUMBER
REQUEST NEW BALANCE FORWARDS
REQUEST BUDGET TOTALS
GL2
DR 1
RUN GENERAL JOURNAL "LEDGER" BY ACCOUNT #
NEXT MONTH'S GENERAL "LEDGER" BEGINNING BALANCES IMMEDIATELY FOLLOWING CURRENT GENERAL LEDGER
DR 1
MONITOR PROGRESS OF JOB
LISTING OF GENERAL JOURNAL "LEDGER" IN ACCOUNT # ORDER WITH ALL NECESSARY TOTALS IN BALANCE SHEET & OPERATING STATEMENT FORM
THIS MONTH'S MONTHLY BUDGET ON END OF FLOPPY (CONSECUTIVE FILE)
DR 1
LOOK OVER RUN FOR ERRORS
GLMENU
DID WE MAKE ANY MONEY?
STEP 14
PROGRAM "GL2"
CURRENT GENERAL "LEDGER" NEW BALANCE FORWARDS FROM STEP 13
ENTER FILE DATE REQUEST
1. TAB
2. CTRL ON ACCT#
DR 1
"GL2"
LISTING OF NEW BALANCE FORWARDS WHICH PRODUCE BALANCE SHEET & OPERATING STATEMENT
PRINTED BALANCE SHEET & OPERATING STATEMENT
MONITOR PROGRESS OF JOB
GLMENU

Figure 7.

CENTRALAB MONOPANEL KEYBOARDS

The TOUCH Switch System ...



...Now available from Centralab Distributors

You'll meet keyboard requirements faster, easier and at surprisingly low cost with MONOPANEL — Centralab's touch-sensitive keyboards. They help solve design problems, simplify and reduce cost in assembly and production and give your product a competitive edge in appearance, design and function. And now, 16 standard keyboards are in stock for immediate delivery from Centralab Distributors.

Don't confuse MONOPANEL with other keyboards. Even though they're priced about the same, MONOPANEL keyboards are superior in construction, reliability, quality and value. First of all, they're backed by Centralab's more than half-century of experience in switch manufacturing. They're 100% tested. They're tough — designed for long, trouble-free life; have no mechanical parts to wear out. And they've been proven in use. The basic Monopanel key switch has undergone more than 70,000,000 switching cycles without failure.

Your Centralab Distributor can furnish 16 standard keyboards. Select from 12 or 16 positions; with alpha-numeric or telephone format numeric nomenclature; white or black bezel; with or without mounting flange. All units have .025" square terminals that are suitable for solder, wirewrapped or plug-on quick connects. One side common or X-Y switch interconnections are available.

For complete product and price information contact your Centralab Distributor. Or, for the name of your distributor, call Centralab Distributor Products, Milwaukee (414)228-2911.

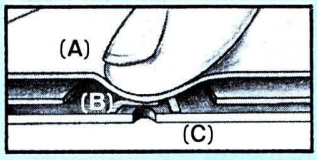
Products you need from people who care.

DISTRIBUTOR PRODUCTS

CENTRALAB

Electronics Division
GLOBE-UNION INC.
5757 NORTH GREEN BAY AVENUE
MILWAUKEE, WISCONSIN 53201

THIS IS HOW MONOPANEL WORKS

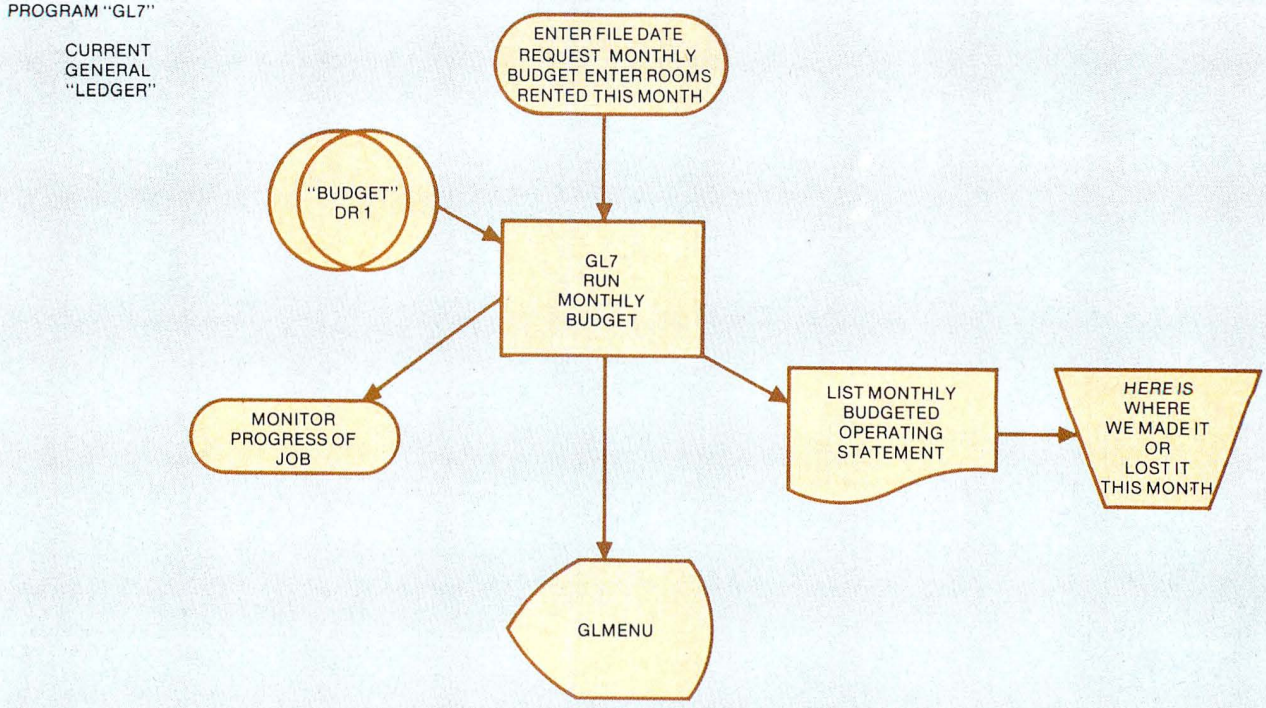


To Give You Long-Life, Trouble-Free Keyboards.

MONOPANEL is a thin, light, flat, front panel subassembly with micro - motion touch switches already mounted and interconnected. Each MONOPANEL is a multilayer assembly containing **(A)** a flexible, tough, moisture proof polyester membrane with graphics and flexible conductors screened upon the rear surface; **(B)** a thin spacer with holes for each switch provides an .007" air-gap; **(C)** a circuit board with switch circuits on its face, joined by plated through-holes to interconnections on its back.

The basic switch closure is momentary, normally open. Light touch pressure (2 oz. typical) on the smooth, flexible front panel closes the contact. Releasing pressure allows the front panel membrane to return, opening the contact.

Ceramic capacitors • Filters • Thick Film Circuits • Switches • Potentiometers • Trimmer Resistors


STEP 15
PROGRAM "GL7"
CURRENT GENERAL "LEDGER"
ENTER FILE DATE REQUEST MONTHLY BUDGET ENTER ROOMS RENTED THIS MONTH
"BUDGET" DR 1
GL7 RUN MONTHLY BUDGET
MONITOR PROGRESS OF JOB
LIST MONTHLY BUDGETED OPERATING STATEMENT
HERE IS WHERE WE MADE IT OR LOST IT THIS MONTH
GLMENU

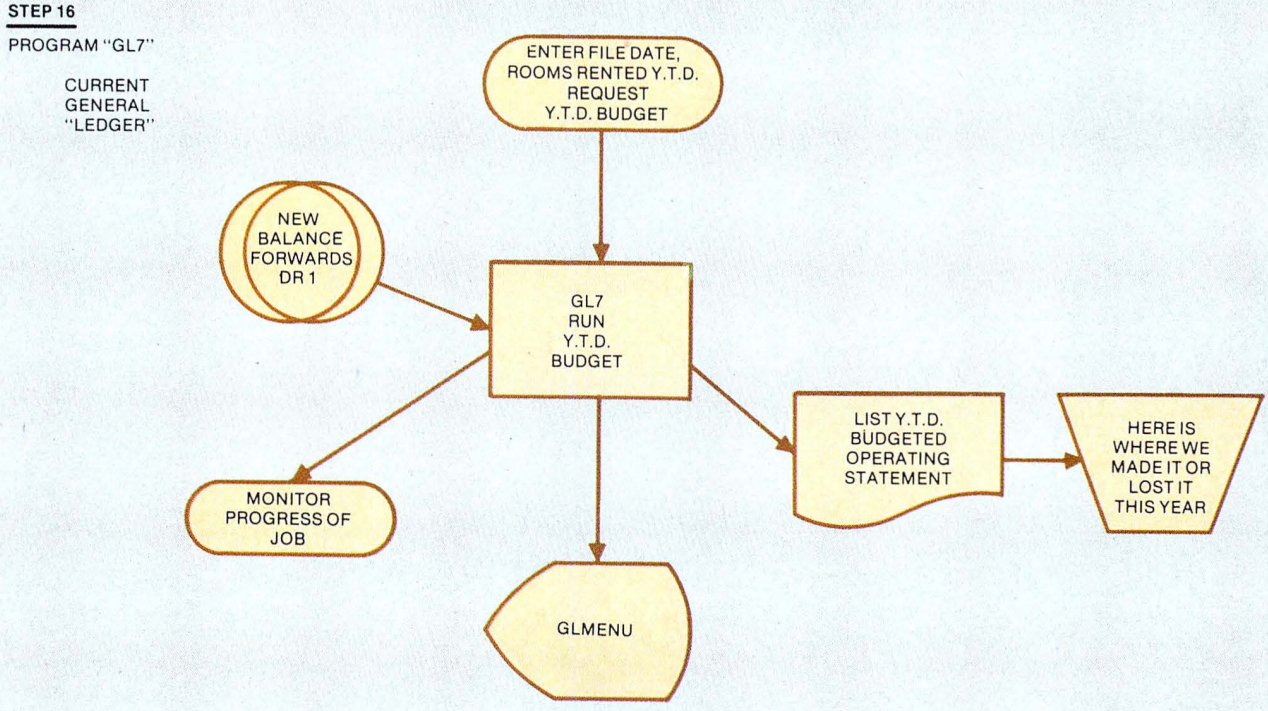
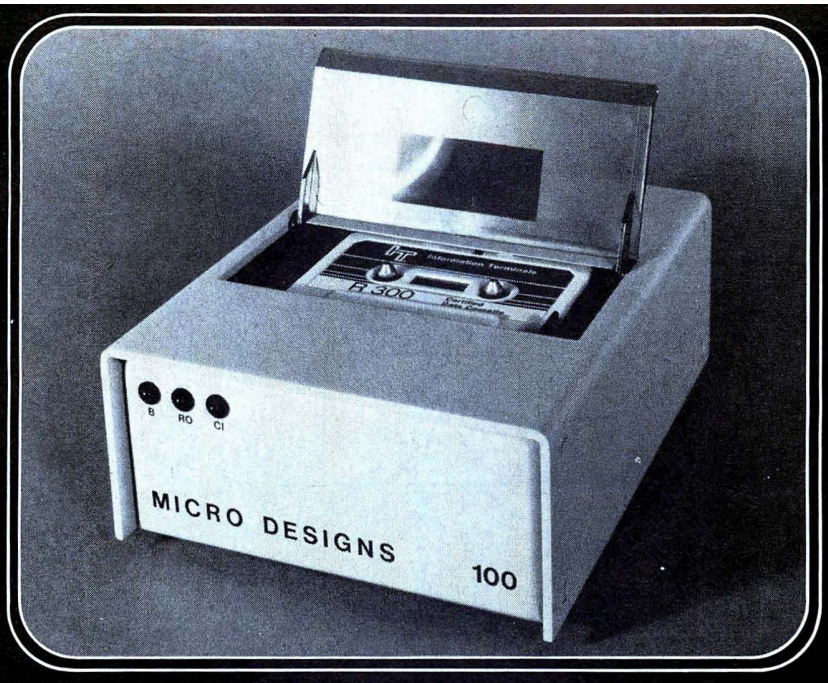

STEP 16
PROGRAM "GL7"
CURRENT GENERAL "LEDGER"
ENTER FILE DATE, ROOMS RENTED Y.T.D. REQUEST Y.T.D. BUDGET
NEW BALANCE FORWARDS DR 1
GL7 RUN Y.T.D. BUDGET
MONITOR PROGRESS OF JOB
LIST Y.T.D. BUDGETED OPERATING STATEMENT
HERE IS WHERE WE MADE IT OR LOST IT THIS YEAR
GLMENU

Figure 8.



THE FIRST REAL ALTERNATIVE TO DISK STORAGE FOR THE S-100 BUS

MICRO DESIGNS introduces the Model 100 and Model 200 Digital Cassette Mass Storage Systems. A high speed seek function and formatted data structure make these systems practical alternatives to floppy disks. These design features allow quick read and write access to individual records without altering other data on tape.

Our systems offer:

- Complete file management package on cassette with each unit.
- Random access capability — 4096 individually accessible records on each cassette.
- File copy capability on the dual drive Model 200.
- High data capacity — ½ megabyte per cassette.
- High speed seek to individual records at 120 in/sec. Worst case access less than 30 seconds.
- Hardware CRC for soft error recovery — Soft error rate less than 1 in 10^8 bits.
- Bootstrap loader in onboard PROM.

The MICRO DESIGNS Models 100 and 200 are fully assembled and rigorously tested at the factory. They come ready for immediate use.

MODEL 100 . . . . $600
MODEL 200 . . . . $875

Contact your local computer store for a demonstration or additional information.

Or write or call us directly.

MICRO DESIGNS, INC.
499 Embarcadero
Oakland, CA 94606
(415) 465-1861

CIRCLE INQUIRY NO. 26

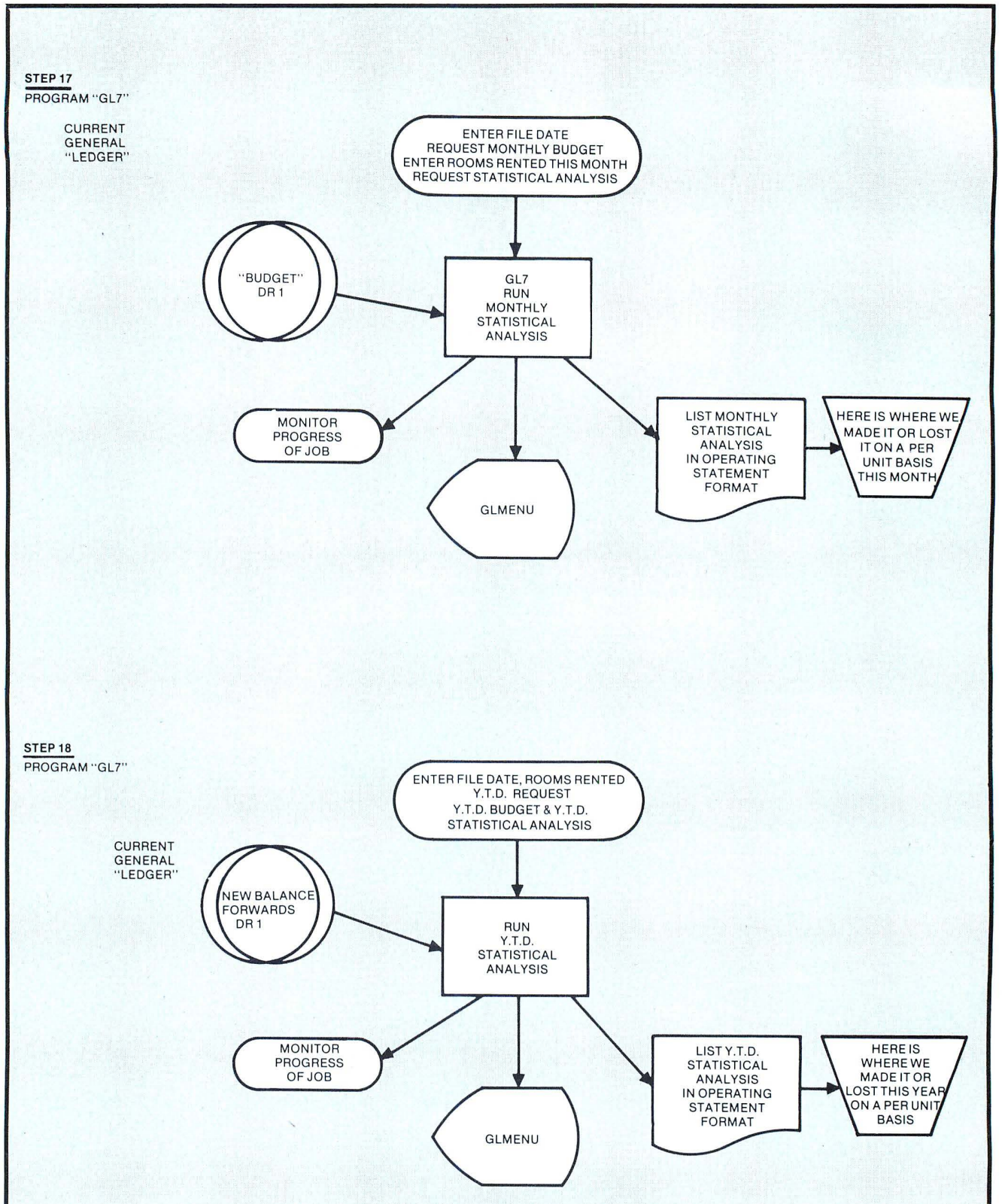

STEP 17
PROGRAM "GL7"
CURRENT GENERAL "LEDGER"
ENTER FILE DATE
REQUEST MONTHLY BUDGET
ENTER ROOMS RENTED THIS MONTH
REQUEST STATISTICAL ANALYSIS
"BUDGET" DR 1
GL7 RUN MONTHLY STATISTICAL ANALYSIS
MONITOR PROGRESS OF JOB
GLMENU
LIST MONTHLY STATISTICAL ANALYSIS IN OPERATING STATEMENT FORMAT
HERE IS WHERE WE MADE IT OR LOST IT ON A PER UNIT BASIS THIS MONTH
STEP 18
PROGRAM "GL7"
CURRENT GENERAL "LEDGER"
ENTER FILE DATE, ROOMS RENTED
Y.T.D. REQUEST
Y.T.D. BUDGET & Y.T.D.
STATISTICAL ANALYSIS
NEW BALANCE FORWARDS DR 1
RUN Y.T.D. STATISTICAL ANALYSIS
MONITOR PROGRESS OF JOB
GLMENU
LIST Y.T.D. STATISTICAL ANALYSIS IN OPERATING STATEMENT FORMAT
HERE IS WHERE WE MADE IT OR LOST THIS YEAR ON A PER UNIT BASIS

Figure 9.

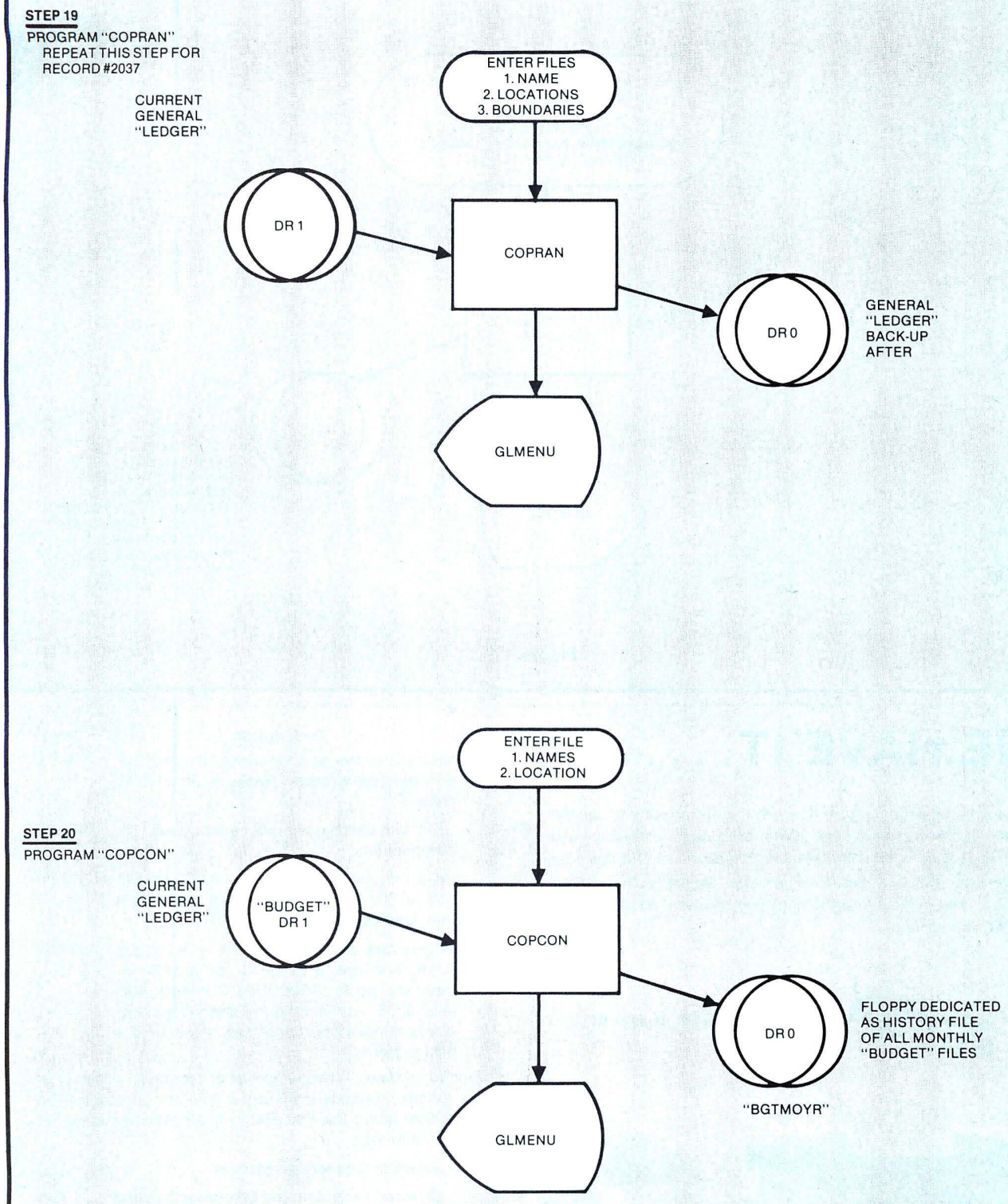

STEP 19
PROGRAM "COPRAN"
REPEAT THIS STEP FOR
RECORD #2037
CURRENT
GENERAL
"LEDGER"
ENTER FILES
1. NAME
2. LOCATIONS
3. BOUNDARIES
DR 1
COPRAN
DR 0
GENERAL
"LEDGER"
BACK-UP
AFTER
GLMENU
STEP 20
PROGRAM "COPCON"
CURRENT
GENERAL
"LEDGER"
ENTER FILE
1. NAMES
2. LOCATION
"BUDGET"
DR 1
COPCON
DR 0
FLOPPY DEDICATED
AS HISTORY FILE
OF ALL MONTHLY
"BUDGET" FILES
"BGTMOYR"
GLMENU

Figure 10.

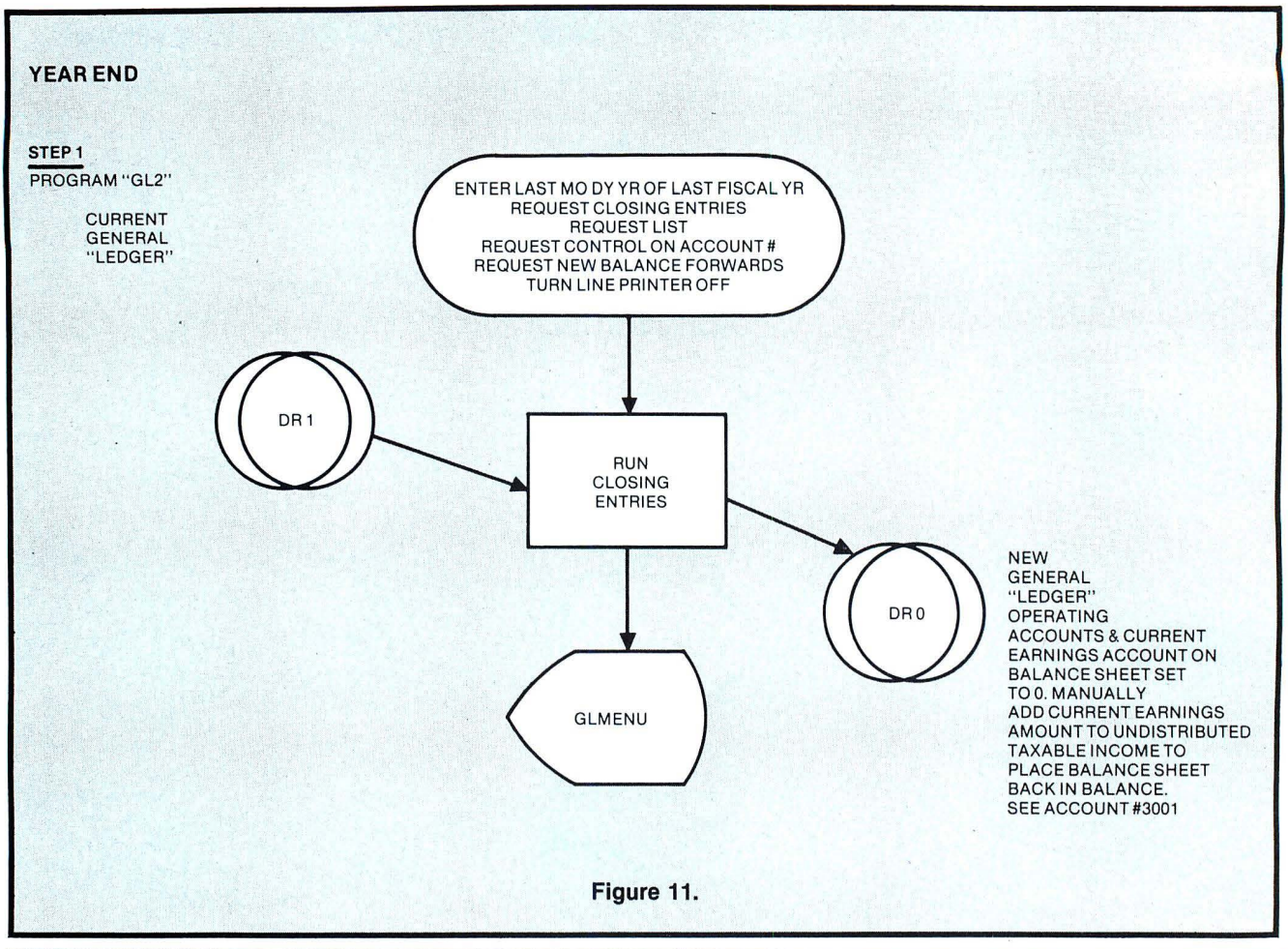


Figure 11.

Have you been waiting for a hard copy printer that doesn't come with a high price tag or very limited performance and features?

Your wait is over. The new Integral Impact is precisely what you've been looking for. It's a micropriced, maxi-performance, full-size, full feature, impact printer that's ready to plug directly into your mini or micro-computer system. No special hardware or software interfacing required. Just attach a standard RS-232 or current loop serial interface, and you're in business.

The Integral Impact is a complete professional printer that's fully assembled, tested and ready for use. No extra-cost options, nothing to assemble or wire, no special software to write . . . and no need, either, for expensive special paper. It prints the standard ASCII set of 64 characters using a 5 x 7 dot matrix at speeds to 120 characters per second. . .on full-size, 8½-inch paper in fan-fold or roll form.

You can even print multiple copies with up to 132 characters per line. With a long-life (10,000,000 character) ribbon that is automatically re-inked during printing, and a rugged print mechanism with few moving parts, the Integral Impact offers you outstanding service and reliability.

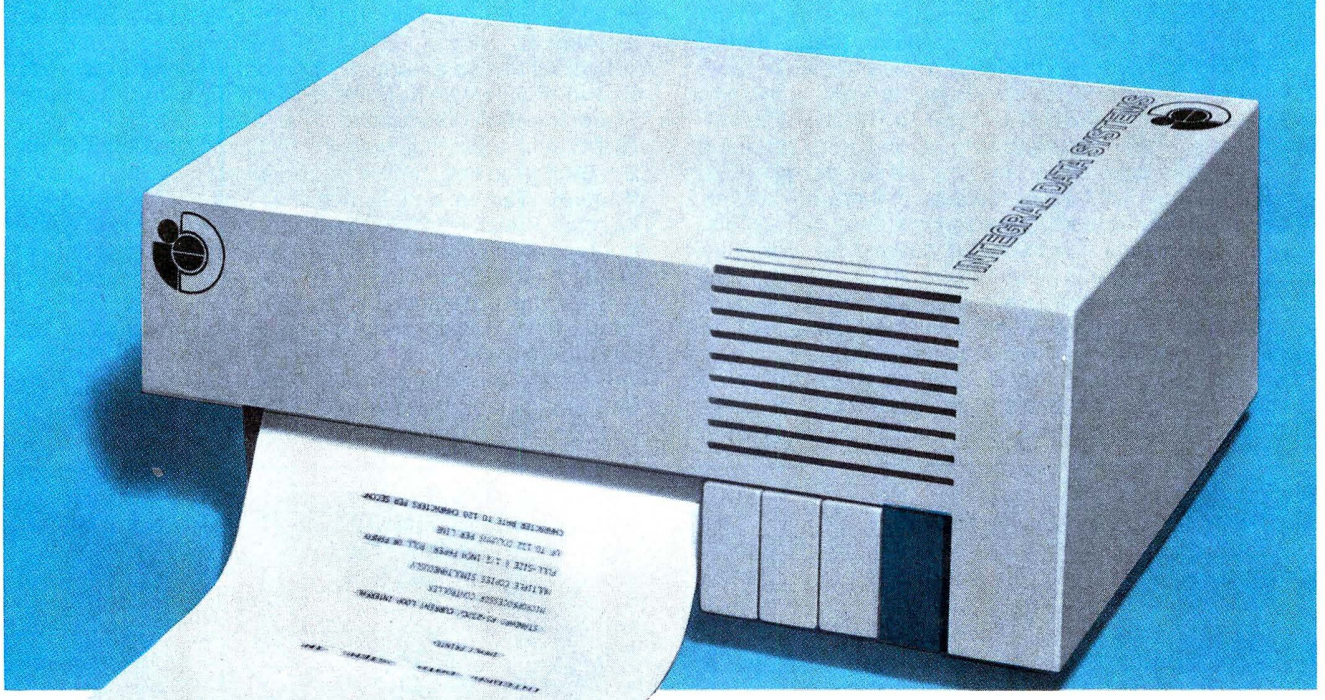
The Integral Impact has a microprocessor-based controller that features variable character pitch sizes, multiple line buffering and enhanced, double-width characters. Serial baud rates from 110 to 1200 bits per second are supported or, optionally, the printer may be used with a parallel interface. Operator controls for power, printer mode and off-line paper motion are conveniently located on the front panel. Internal switch settings determine serial baud rate, character pitch and number of characters per line.

The micro-price: $745.00 complete.

Where can you get it? Send the coupon below to Integral and we'll ship direct to you. Or have us send you full details by checking the appropriate box on the coupon.

Make big printer performance an integral part of your system . . . with the Integral Impact.

Now...big printer performance at a mini-printer price.



Integral Data Systems INC

5 Bridge Street • Watertown, MA 02172 • (617) 926-1011

I want big printer performance now.

Here's my check for $

Bill my VISA Mastercharge account

Account No. Expiration Date

M C Interbank No.

Signature

____ Send more information

Name

Address

City State Zip

*Handling and shipping charge: $5.00. Mass. residents add 5% sales tax.

HOW TO LOAD THE FLOPPY ROM

by William W. Turner

WARNING . . . Failure to read this article before attempting to load the floppy may be hazardous to your health, especially if you do not have an 8080 system capable of running version 4.0 or 4.1 of ALTAIR DISC EXTENDED BASIC. This is an absolute requirement, as the programs are all stored on the FLOPPY-ROM in ALTAIR's internal format. Also required is a TARBELL cassette interface strapped for 187 characters per second operation, an 80 column line printer, and a CRT terminal. A floppy disk drive and 48K of memory is also required.

Users of other BASIC systems will not be able to use the programs without first undertaking some sort of conversion activity. Most BASIC systems do not support the LPRINT command which is being used to direct printing operations to the line printer, and these commands would have to be changed to a "PRINT" statement. The other major area of incompatibility is due to the fact that the ALTAIR software does not allow programs to be saved on tape in a normal ASCII format. Instead ALTAIR software compresses the keywords into a unique one or two byte code and then saves the programs. This allows a faster operation to and from tape (less data to transmit!).

The best method of loading the programs into your 8080 computer system, according to Lou Van Eperin and Jim Rembis of the Chicago Computer Store, is to play back the FLOPPY-ROM on a medium grade stereo system and to re-record the data onto a cassette tape. The Tarbell interface is sensitive to both tone and volume settings, so expect to have to "diddle" the settings a little, either during recording or during playback of the cassette tape. Once you find the correct settings, you should have no further trouble. If there are any errors while trying to load the programs, they will usually show up as strange line numbers beyond the last valid line in each program. Should this occur adjust your volume and/or tone settings a little and try again. Use the information contained in Table 1 to assist you in verifying the accuracy of the program loads.

Each program was given a unique 1-character name on the cassette tape and this name should be used when loading the programs into your computer system. After each program is loaded, you should then save it under its real name on the disk. A typical sequence would be:

```
CLOAD A
SAVE COPCON
```

The Disk names and the tape names can also be found in Table 1.

If you are normally running version 4.1 EXTENDED BASIC, then you should unload the cassette tape into your system using the Version 4.0 system, saving the programs on your disk in ASCII format. After loading all programs in this manner bring up version 4.1 and resave the programs on your version 4.1 diskette as normal program files. This will eliminate any possible problems regarding incompatibilities between version 4.0 and 4.1. This precaution may not be absolutely necessary, for I have been told that the internal codes in both 4.0 and 4.1 are supposed to be the same. However, I have no way of personally verifying this, as my own personal system is a SWTPC 6800.

The first thirty seconds on side 1 of your FLOPPY-ROM is a sync stream which will allow you to set the phase on your recorder if necessary. The running times of all the programs on the FLOPPY-ROM are identified in Table 1.

I would like to extend my personal thanks to Lou Van Eperin and James F. Rembis of the Chicago Computer Store for their assistance in producing this FLOPPY-ROM; also assisting was Terry Marshall, Don Tarbell, Bill Blomgren and Jimmy Hoehn located in Chicago, Los Angeles, Tampa and Tampa . . . Special thanks go to Norman Welch at EVA-TONE and his staff for the long hours that they devoted to this project; and last, but not least, if Bud Shamburger in Conwal, Arkansas hadn't written the programs in the first place, then maybe I would have gotten some sleep in the evenings of the past four weeks . . .!

Please direct any correspondence regarding any difficulties or lack thereof to INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.

FLOPPY ROM	**SIDE 1:**			
PROGRAM NAME (DISK)	NAME ON TAPE	LINE NUMBERS	APPROXIMATE PROGRAM SIZE	RUNNING TIME (ON TAPE)
COPCON	A	10 - 360	990	6 sec
COPRAN	B	10 - 640	1,664	10 sec
GETPUT	C	10 - 630	1,969	12 sec
GL1	D	10 - 2480	9,237	60 sec
GL2	E	10 - 7330	20,529	120 sec
FLOPPY ROM	**SIDE 2:**			
GL3	F	10 - 1300	4,250	25 sec
GL4	G	10 - 1220	3,122	19 sec
GL5	H	10 - 1680	5,125	30 sec
GL6	I	10 - 1600	6,511	39 sec
GL7	J	10 - 4820	15,049	90 sec
GLMENU	K	10 - 520	2,026	12 sec
SORTGL	L	10 - 2210	6,999	41 sec

System used to record data: ALTAIR 8800B with 48K of memory and TARBELL cassette interface. Software used was ALTAIR DISK EXTENDED BASIC, VERSION 4.0 with TARBELL cassette interface patches installed.
Other hardware used: ALTAIR 88-DC00 Floppy Disk, Lear Siegler ADM-3A. Tarbell card strapped for 187 bytes per second.

Table 1.

yours

*mem · o · ry/"mem-(ə)re/n,
a: the power or process of reproducing or recalling what has been learned and retained esp. through associative mechanisms
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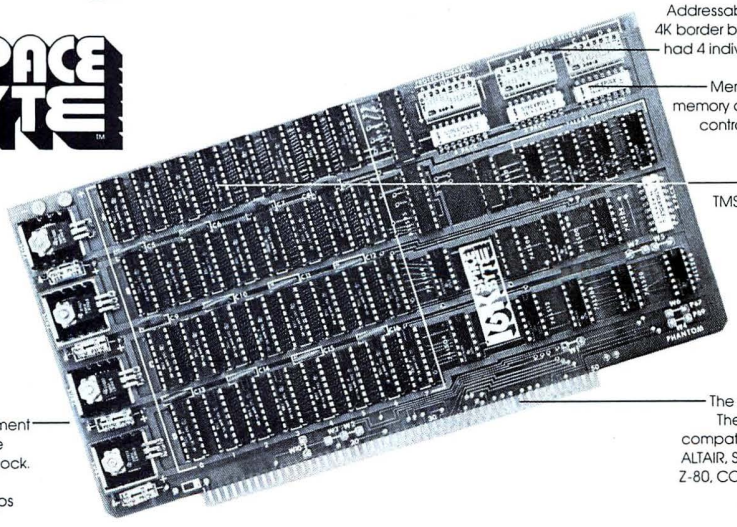
*definition according to Websters New World Dictionary



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CIRCLE INQUIRY NO. 47

The Radio Shack TRS-80 Microcomputer System

by Steven W. Leininger
Engineering Manager, Tandy Advanced Products

The new Radio Shack TRS-80 microcomputer system incorporates many design features which work together, giving users a higher performance/price ratio than has been previously available. The basic $599.95 system consists of four components: the TRS-80 microcomputer, 12-inch video monitor, power supply, and cassette recorder.

The TRS-80 microcomputer is housed in a rugged ABS plastic case. What at first may appear to be merely an alphanumeric keyboard assembly is in fact an entire microcomputer. Figure 1 shows a block diagram of the contents of the TRS-80 microcomputer.

The Z-80 microprocessor chip was selected for use in the TRS-80 microcomputer. The decision to use the Z-80 CPU was made after careful examination of the available CPUs. After comparing the amount of hardware required to use the various microprocessors, the actual chip cost, the efficiency of the machine's language, and the availability of prototyping equipment, it became apparent that the Z-80 was the hands-down winner.

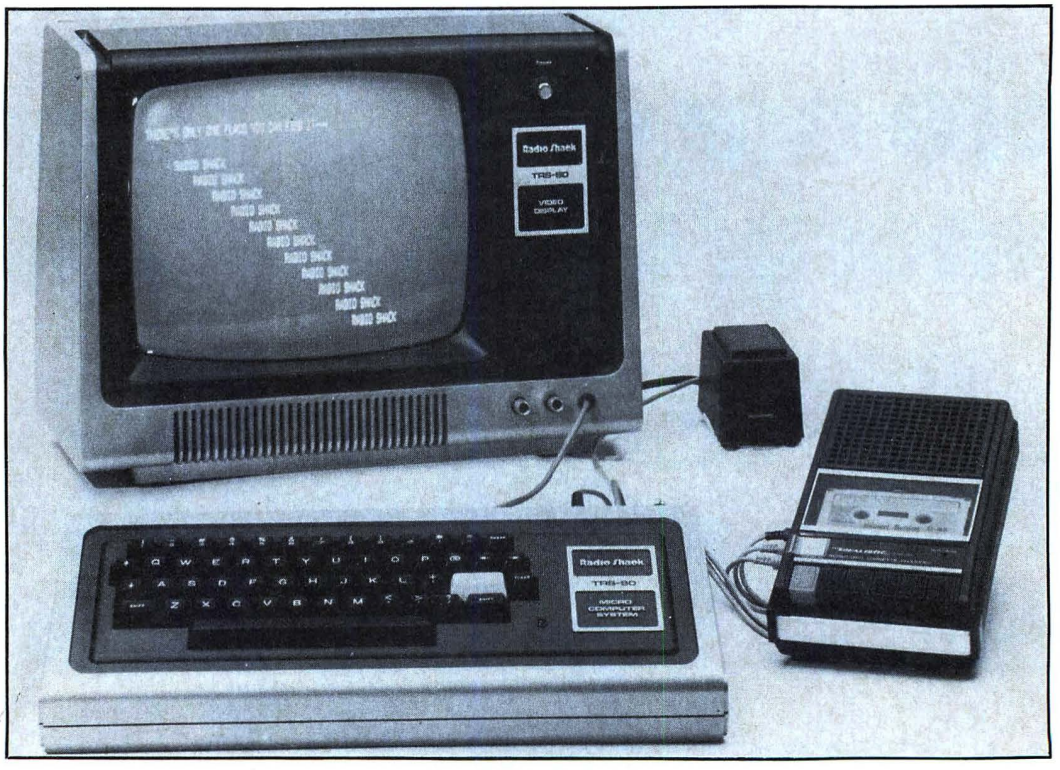
The Z-80 address, data, and control lines are buffered and routed to the different functional blocks in the TRS-80. The clock input to the Z-80 is derived from the video counter chain and has a period of 563 nanoseconds.

The ROMs contain the Radio Shack Level I BASIC, the keyboard scanning routines, the video display drivers, and the cassette interface routines. These ROMs are of the mask-programmable (non-erasable) variety, and total 4096 eight bit bytes — up to 12K bytes of ROM can be supported using the jumper selectors internal to the TRS-80.

The TRS-80 uses dynamic RAMs for the main program storage area. By using simple jumper options, 4K, 8K, and 16K RAMs can be used to tailor the internal memory size as required. All dynamic memories require periodic refreshing to prevent loss of their stored memory data.

The TRS-80 microcomputer takes advantage of the automatic refresh capabilities of the Z-80 CPU to reduce the hardware overhead normally associated with dynamic RAMs to just a couple of ICs.

The keyboard is a full size, professional quality 53-key unit. The interface between the keyboard and the microprocessor is elegant in its hardware simplicity. Each switch on the keyboard represents a cross-point on an 8 x 8 matrix. The matrix input is driven by the eight low-order address bits through open collector buffers. The matrix output is sensed by inverting tri-state buffers. Through software manipulation of the address lines, any key enclosures can be sensed and decoded, thus providing complete keyboard encoding at a very low cost.



Radio Shack TRS-80 Microcomputer System

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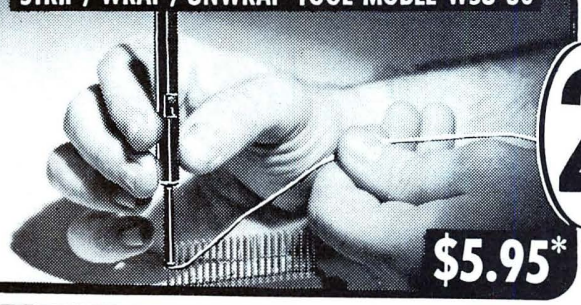

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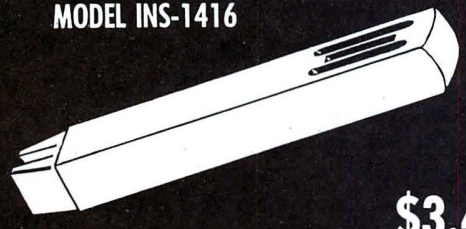

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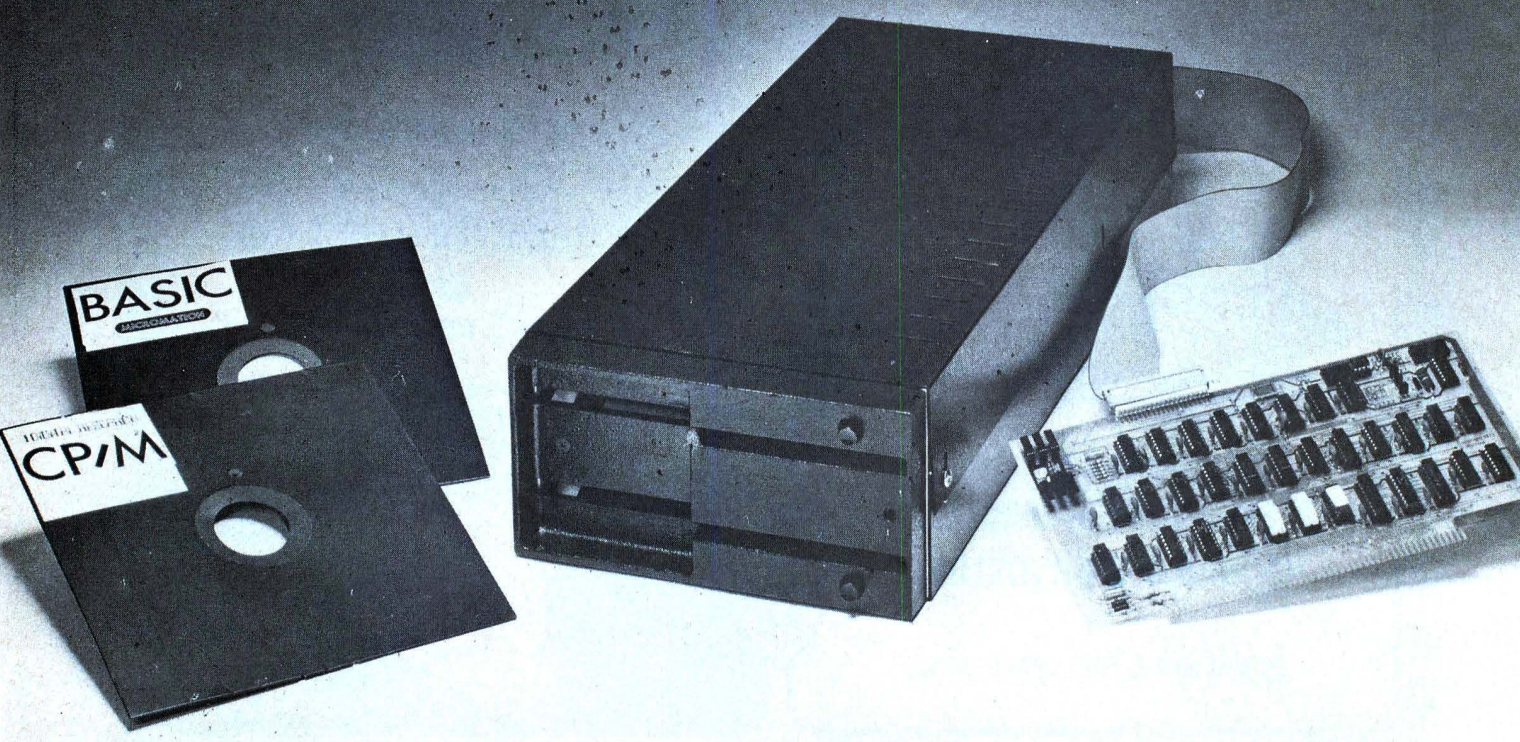

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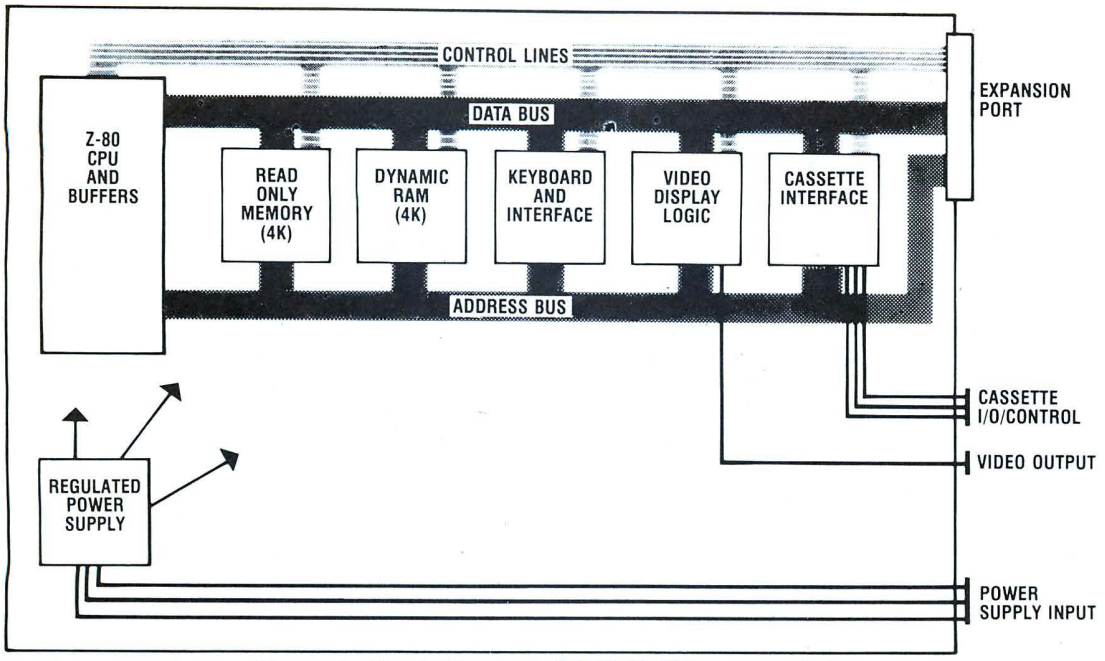


Figure 1. Block Diagram of TRS-80 Microcomputer

The video display logic generates the necessary video and sync signals to form 16 lines of 64 alphanumeric characters. This logic includes 1K words of 7 bit RAM, a count-down chain, RAM address select, ASCII character generator, and shift register. The RAM is accessed by the Z-80 only when information is to be read from or written to the screen.

The Z-80 block data move instructions simplify the software controlled scrolling. The count-down chain provides all the signals necessary to generate a sync signal, the appropriate video RAM addressed and the dot clock. The dot clock is used to drive the shift register, which contains either character information from the character generator or graphics information from the graphics multiplexer.

The graphics in the TRS-80 are displayed on a character-by-character basis. The regular alphanumerics are displayed as a 5 x 7 dot matrix in a 6 x 12 cell. When the high-order bit of the video RAM is a logical 1, the cell is divided into a 2 x 3 graphicable character. The basic routines, **SET, RESET,** and **POINT** convert from user given X and Y coordinates to a respective programming task which incorporates the TRS-80 graphics.

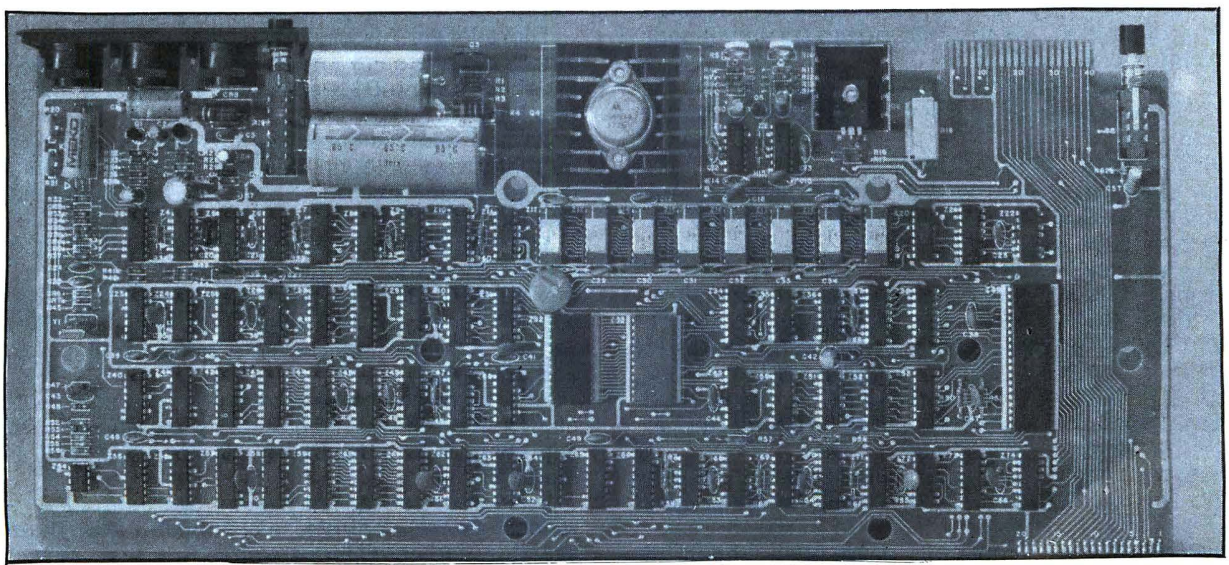
A standard 75 ohm video output is provided for connection to a video monitor.

The cassette interface chosen is the best compromise of reliability and low cost. Using a recording scheme similar to that used on floppy discs, the software driven cassette interface stores a logical 0 as a single pulse, while storing a logical 1 as a pair of pulses. The interface software runs at approximately 250 baud. To allow for limited cassette file handling, a relay is provided to turn the cassette recorder on and off.

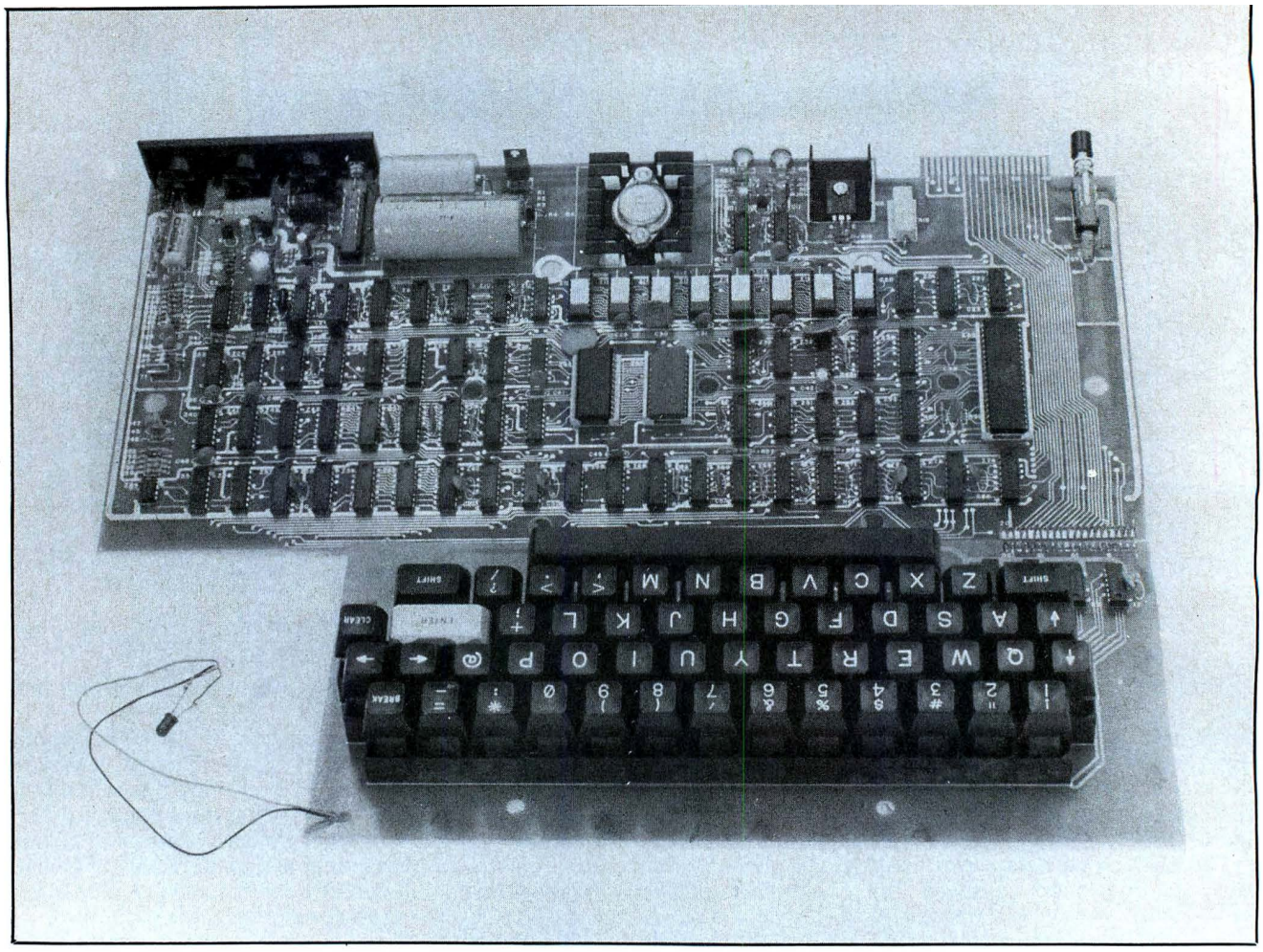
The regulated power supply uses a discrete closed loop voltage regulator in the + 5 volt and + 12 volt supplies, insuring reliable and predictable power supply operation. Due to the low current requirements of the − 5 volt supply, a zener regulator was used. Both the + 5 and + 12 volt supplies have fold-back current limiting; the + 5 volt supply additionally has crowbar overvoltage protection.

The U.L. approved stepdown transformer is external to the main computer due to size limitations and thermal considerations.

To allow for expansion of memory and the addition of peripherals, an expansion port was supplied. The ad-



PC board assembly of the TRS-80 Microcomputer System



PC board assembly of the TRS-80 Microcomputer System with integrated 53-key professional-type keyboard.

dress bus, data bus, input, output, read, write, interrupt, and interrupt acknowledge signals are available on a 40-pin card edge at the rear of the TRS-80. A cable may be run from this expansion port to the TRS-80 expansion module, floppy disc, and/or printer.

The TRS-80 video display is a raster scan monitor with a bandwidth in excess of 6 MHz. It has a standard 75 ohm input so that it can be used with the TRS-80 or any other piece of equipment with a standard video output. The video input signal is isolated from the CRT circuitry by using an optical isolator. This provides a tremendous margin of operator safety.

The cassette interface recorder supplied in the TRS-80 microcomputer system is a standard audio cassette unit.

RADIO SHACK LEVEL I BASIC

This BASIC is a floating point BASIC with cassette handling, graphics, and limited string capability. The numeric range is approximately $10^{\pm 38}$, with seven digits of accuracy (six displayed).

Standard BASIC commands supported are: NEW, LIST, RUN, CONT, REM, LET (optional), FOR-NEXT-STEP, GOSUB-RETURN, STOP, END, GOTO, IF-THEN, INPUT, ON . . . GOTO, ON . . . GOSUB, PRINT, DATA, READ, and RESTORE. The commands for cassette I/O include CLOAD and CSAVE for entire programs and INPUT# and PRINT# for data files.

Standard BASIC functions include INT(x), TAB(x), ABS(x), RND(x), +, −, *, /, >, <, =, and MEM (Memory Size FUnction).

Several unique commands have been added to enhance the value of the Radio Shack Level I BASIC. These include:

CLS	- Clear Screen.
SET(x,y)	- Turn on graphical segment at (x,y) (x = 0 – 127, y = 0 – 4).
RESET(x,y)	- Turn off graphical segment at (x,y).
POINT(x,y)	- Function that returns 1 if (x,y) is on, 0 if it is off.
PRINT AT(x)	- Direct cursor control (x = 0 to 1023).

The allowed numeric variables are A through Z. A single dimensioned array A(x) is available. The string variables A$ and B$ are each a maximum of 16 characters long.

Several applications programs written in BASIC are currently available on cassette, including blackjack, backgammon, payroll, math tutoring, and personal finance.

The engineering and programming staff at Tandy Advanced Products are developing new products to augment the TRS-80 microcomputer. New applications software includes general ledger, accounts receivable, inventory control, music theory, programming tutoring, and space war.

New hardware, to be available in the near future, includes line printers, floppy discs, expansion units (for additional PC cards), serial I/O /Modems, and add-on memory.

In addition, advanced system software, such as extended BASIC, editors, assemblers, disc operating systems, and compilers are already in the works.

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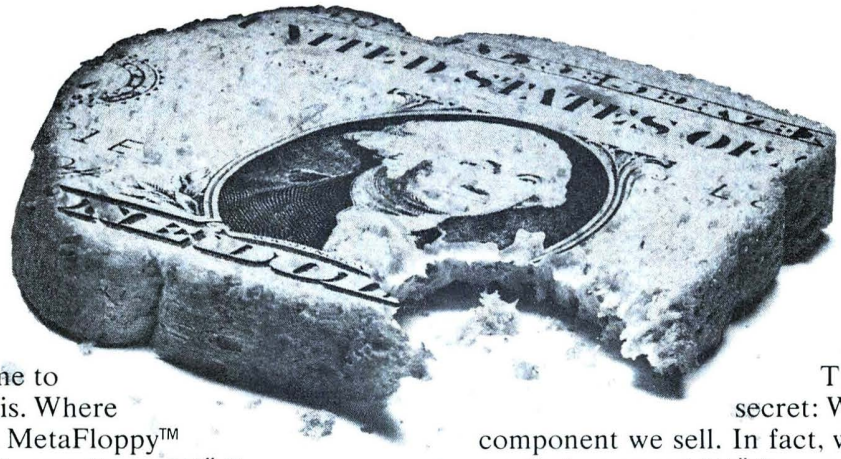

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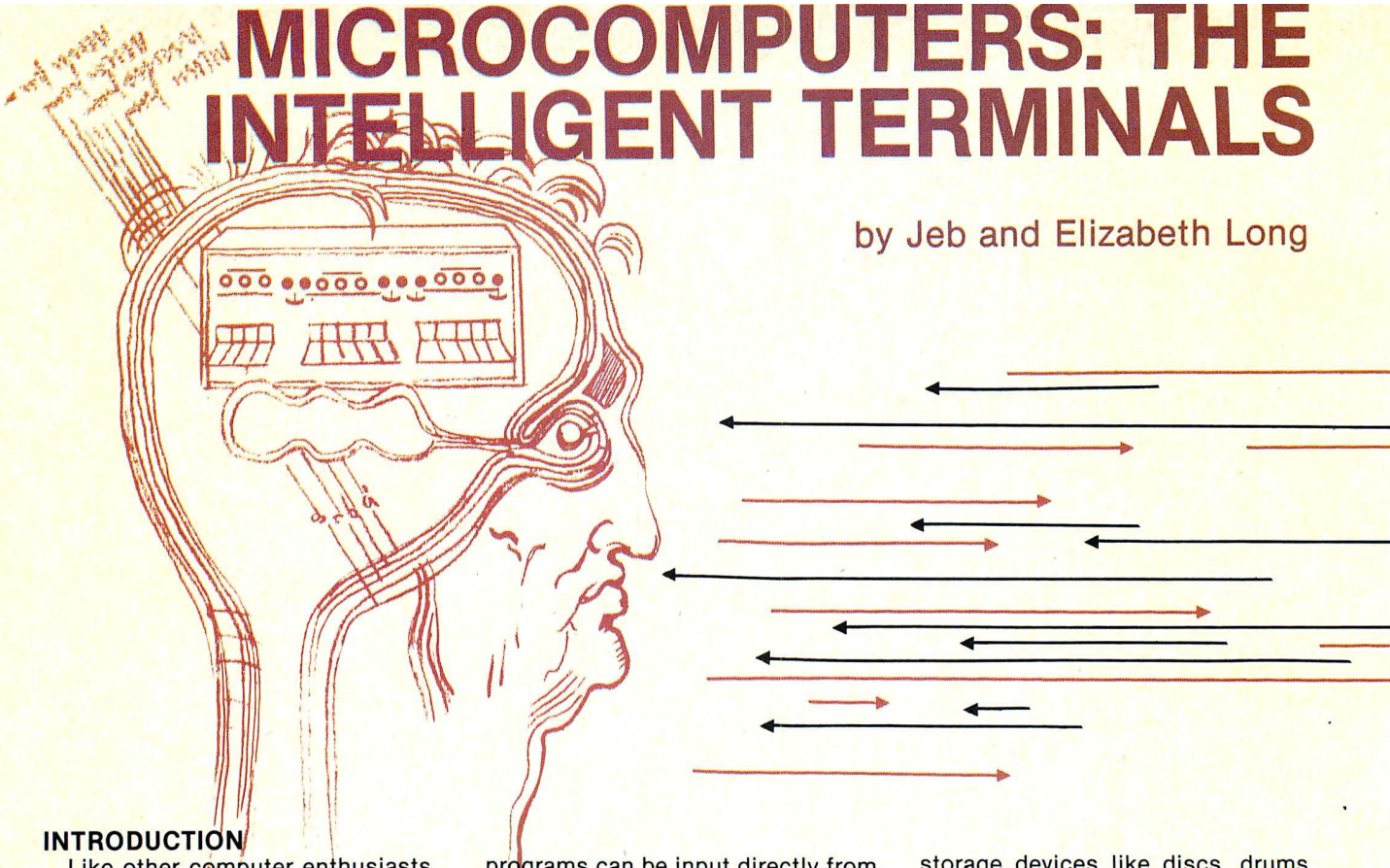
MICROCOMPUTERS: THE INTELLIGENT TERMINALS

by Jeb and Elizabeth Long



INTRODUCTION

Like other computer enthusiasts, we continually search for efficient and inexpensive methods of improving communication between us and our remote timeshare computer (TSC). We have found a way to improve the interface between man and machine by using our Altair 8800 microcomputer as an intelligent terminal to expand the capacity of our timeshare computer. Furthermore, the versatility of this software-controlled device has the capacity of tailoring its control functions to the unique needs of each individual user.

For instance, the 8080 software system which we developed transmits input from the user's keyboard to a remote TSC and displays output from the TSC on the local intelligent terminal's video display monitor (VDM) or the hard copy printer. The lower two lines of the VDM 16-line display are used as an edit buffer to exhibit the user's keyboard entries. The contents of the edit buffer can be edited by making use of the various control functions. When satisfied with the contents of the edit buffer line, the user hits a carriage return and the line is transmitted to the TSC. The output from the TSC to the VDM is directed to the upper 14 lines of the VDM.

Additionally, programs in Intel HEX format can be loaded directly into the Altair's 8800's memory directly from the TSC. Even basic programs can be input directly from the TSC to the 8800 BASIC processor if this system is employed.

In effect, this system allows the TSC to be used as a large mass storage device. We find it useful to assemble programs using the cross assembler and the PL/M compiler on the TSC and then to load them directly into Altair's memory for testing and running the newly-assembled program. Of course, the major emphasis of this article is directed toward the 8080 software for the intelligent terminal system. The following paragraphs describe the highlights of our various hardware components.

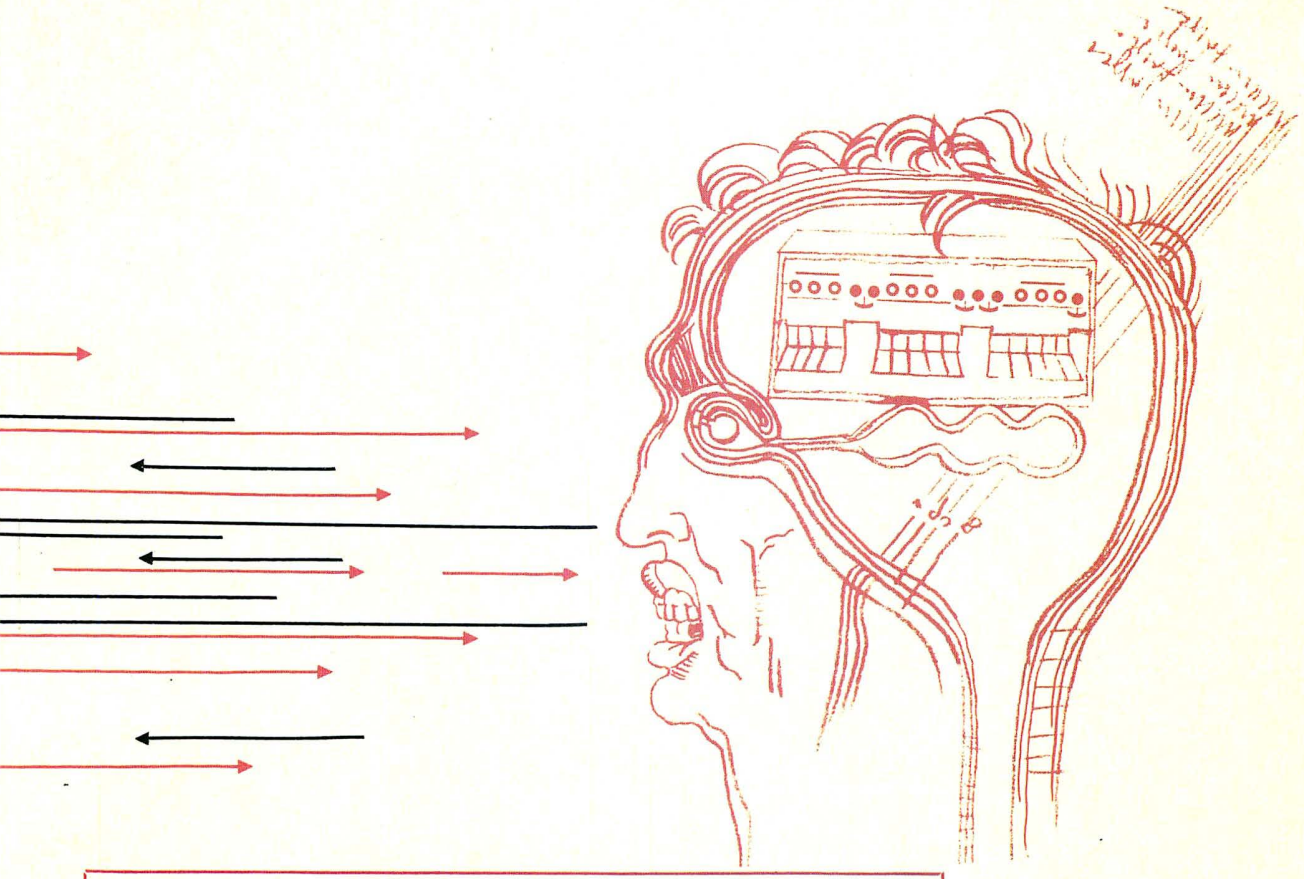
TIMESHARE COMPUTER SYSTEM-INTELLIGENT TERMINAL HARDWARE CONFIGURATION

The total timeshare computer-intelligent terminal hardware configuration consists of a time share computer system, a modem and an intelligent users' terminal. Figure 1 shows the interrelationship between these three major subsystems.

TIMESHARE COMPUTER SYSTEM: The timeshare computer system is made up of either a medium or a large size computer system or network of computer systems that have the ability to interact with a number of user terminals simultaneously. These systems contain a central processor (CPU), memory, mass storage devices like discs, drums, and banks of magnetic tape drives, and also a variety of input/output (I/O) devices such as printers, plotters, and card readers. It is interesting to note that all systems have some form of multiplexer that allows each user to have access to a portion of the full cycle of the computer's multiplexer. Under most circumstances this cycle is so fast that each user feels that he has exclusive use of the entire computer.

MODEM (Modulator/Demodulator): A modem is a device that converts serial data into audible tones which can be transmitted over telephone lines. The tones that are received are then converted back into serial data. Some modems are connected directly to the phone lines, while others are connected through an accoustical coupler. The modem is connected directly to the serial interface in the terminal or computer serial interface.

The computer required for this system must have two I/O interfaces. One interfaces with the terminal and the other interfaces with the modem. The system discussed in this article makes use of a Processor Technology 3 P&S interface board to provide an RS-232 serial interface to the terminal. A MITS 2SIO interface board provides an RS-232 serial interface with either a 300-baud modem with an accoustical coupler or a 1200-baud modem.



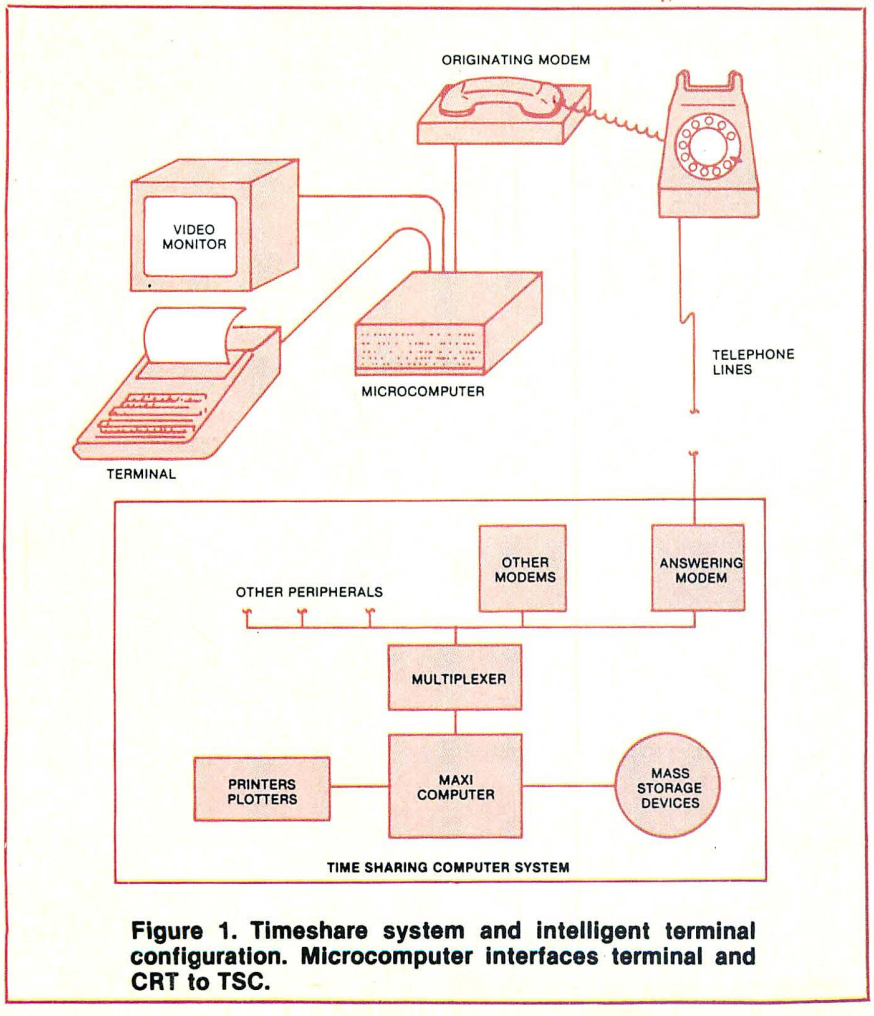


Figure 1. Timeshare system and intelligent terminal configuration. Microcomputer interfaces terminal and CRT to TSC.

The baud rate is software-controlled.

INTELLIGENT USERS TERMINAL: The user terminal is a device that has a keyboard, and it is used to transmit data, and also has some form of display for receiving data. The display device can be a printer or a VDM. A terminal that simply transmits key strokes to the TSC and displays received characters is commonly termed a dumb terminal (DT). In contrast, a terminal that performs various levels of editing and perhaps even supports some high level processor such as BASIC is often called an intelligent terminal (IT).

Our intelligent terminal system uses an Altair 8800 to connect a DT, VDM, and a modem; the result is a fairly smart terminal. This particular combination is depicted in Figure 2 and contains the following components:

- Altair 8800 Microcomputer
- 32K bytes of memory (program uses less than 2.5K)
- Processor Technology VDM board*
- MITS 2SIO dual serial interface board

*The hardware scrolling feature of this display is not used. Therefore this program can be modified to run using VDM boards not supporting this feature such as the PolyMorphic or Solid State Music VDM boards.

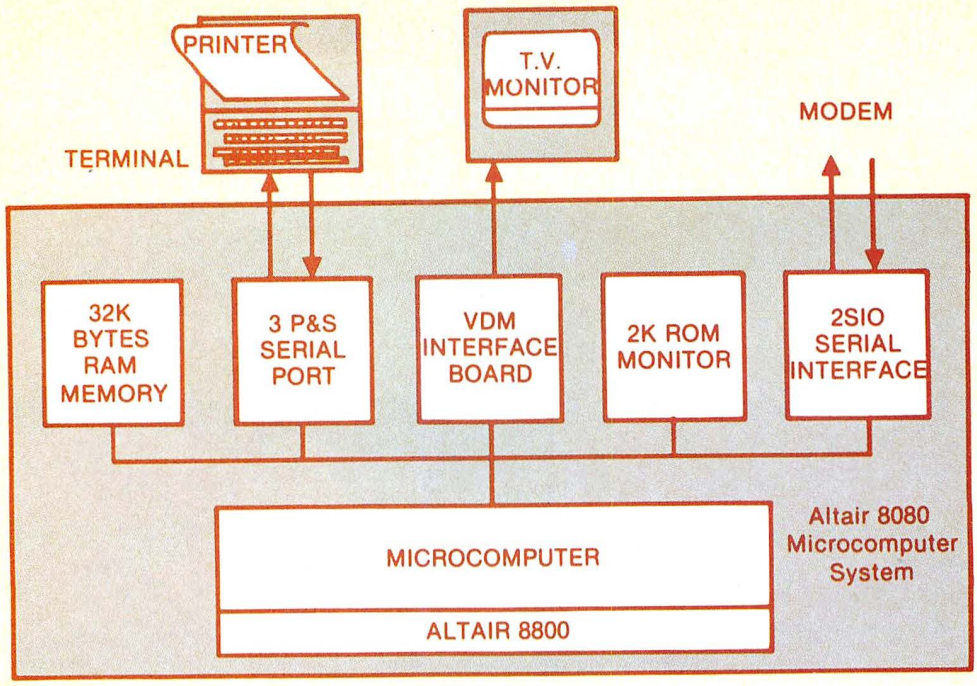


Figure 2. Intelligent Terminal Configuration.

- Processor Technology 3 P and S interface board
- TV monitor
- Terminal with keyboard and printer
- Processor Technology 2KRO (2K ROM monitor)

The Altair microcomputer controls the interaction between the TSC, VDM, terminal keyboard and printer. Only about 2.5K of RAM is used for this terminal. The remaining memory is used for running BASIC and other programs. The ROM monitor contains the code for transferring Intel HEX from the TSC to memory.

INTELLIGENT TERMINAL OPERATION

Before we wade into the discussion of the software, it is advisable to explain the operation of the intelligent terminal system. For instance, we load the system from a cassette by using routines in our monitor, and then we execute the program at location 5000H ($20{,}480_{10}$). The program initializes the modem port to 1200 baud. If we are using a 300-baud modem, we simply enter a control function (GS) to reinitialize the modem port interface to 300-baud, and at this point we call the computer. Once we hear the tone, we set up the modem, and at that point, we're ready to proceed.

The next step is to enter the appropriate protocol which involves entering certain computer access identification passwords and account numbers. Once these initial steps have been completed, we're ready to perform the intended communication with the timeshare computer.

The Processor Technology VDM provides the option of having black characters on a white background. The keyboard entries are displayed in the lower two lines of the 16-line display as black characters on a white background. These lower two lines are called the edit buffer (EB). The data received from the TSC are displayed on Line 14 of the display. The upper 14 lines of data are then scrolled up one line. The contents of the top line are discarded during the scrolling operation. Characters in Line 1 through 14 are displayed with a dark background. (See Figure 3).

The user enters a complete line of characters into the edit buffer and performs any necessary edit function on that line. Once the user is satisfied with the edit buffer contents, he enters a carriage return and the line is transmitted to the TSC. At this point, the entire VDM display is advanced and leaves the edit buffer empty and ready to accept more keyboard entries. Keyboard control functions* (see Table 1) perform many editing operations. They are used to delete characters, clear the buffer, insert characters, position the cursor, and to perform other editing operations. Control functions exist in order to move lines from the upper portion of the screen to the edit buffer, and they transmit stored and canned messages to the TSC. If the user forgets which control function to use, a CTL-U will display all of the CTL functions on the VDM.

DOWNLOADING PROGRAMS INTO RAM MEMORY FROM TSC — A control function exists to load program object information from the TSC directly into the memory and to load BASIC Source programs directly into the MITS 8K Basic version 3.1.* To use these options the user transmits the appropriate commands to the TSC to list the data and then enters CTL-V to load memory or CTL-N or load a BASIC Source program. When the Intel HEX object loading of memory is completed, the HEX loader returns to the terminal control program unless the auto load and go option is used. In this case, the program jumps to the specified address. It is assumed that the BASIC Processor is already loaded and initialized on the VDM as it is entered. Upon completion, the program will jump to the BASIC Processor.

*Keyboard control functions involve pressing the CTRL key and another key at the same time.

*By changing the value of program variable "INBAS" the option will work for other versions of BASIC. This variable is the address of the TTY input routine of BASIC.

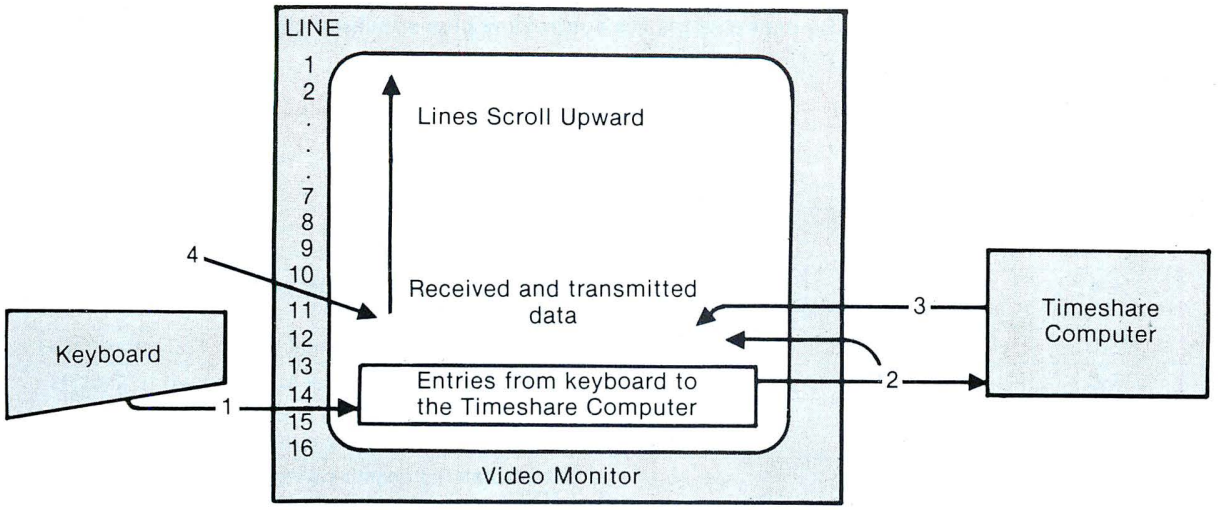


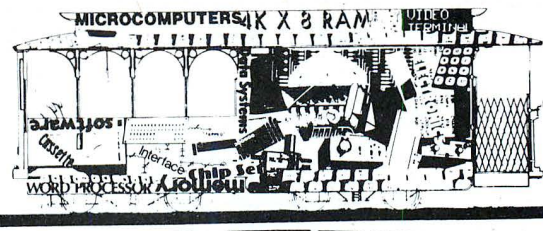
Figure 3. VDM Data Flow is as follows: (1) Keyboard entries are displayed in edit buffer(1), VDM lines 15 and 16. (2 & 3) When carriage return is entered, the edit buffer is transmitted to the TSC(2) and displayed on VDM line 14(3). (4) After something is entered on line 14, the display scrolls up one line, and the top line is discarded.

Table 1. Keyboard Control Function. The user presses the control key plus specified character (1) to perform various editing and terminal control functions.

CTL FUNCTION (1) CTL-Char	(2) CTL Symbol	Only affects edit buffer	USAGE (3)
CTL-@	null/break		Used by Univac 1108 computer as interrupt key. Transmitted to (TSC) upon entry.
CTL-A	SOH		Jump to users 8080 ROM monitor (currently set to B800H).
CTC-B	STX		Transmit canned message one to TSC immediately.
CTL-C	ETX		Jump to ROM assembler (currently set to E000H).
CTL-D	EOT	*	Delete character where cursor sits. All characters to the right of cursor are moved over one position.
CTL-E	ENQ		Immediately transmit canned message two to the (TSC).
CTL-F	ACK	*	Move cursor one position to the left.
CTL-G	BEL	*	Move cursor one position to the right.
CTL-H	BS	*	Move cursor to beginning of edit buffer.
CTL-I	HT	*	Insert blank in text. Character shadowed by cursor and characters to the right of the cursor are moved one position to the right.
CTL-J	Line feed		Not used.
CTL-K	VT		Scroll all 16 lines up one line. Top line is moved to edit buffer.
CTL-L	FF		Scroll all 16 lines down one line. Edit buffer is moved to top line.
	Carriage return	*	Contents of edit buffer (including carriage return) are transmitted to the (TSC).
CTL-N	SO		Load Basic Source Program. CTL-A is entered when loading is completed to terminate loading.
CTL-O	SI		Not used.
CTL-P	DLE		Not used.
CTL-Q	DC1	*	Performs tab function. Moves cursor to the right to next tab position. Tab positions are every 8 positions, e.g. 8, 16, 24, . . .
CTL-R	DC2	*	Reprint edit buffer. This function is used if output to printer option is in effect. If sense switch A8 is on, output is directed to printer.
CTL-S	DC3		Search (VDM) option. Any line on the (VDM) containing a sequence of characters equal to the contents of edit buffer will be moved into the edit buffer. The search begins at the top of the screen.
CTL-T	DC4		Not used.
CTL-U	NAK		A description of all control functions is displayed on the screen.
CTL-V	SYN		Load data in Intel HEX format received from the (TSC) memory. Control returns to the intelligent terminal program when loading is complete unless object code contains auto jump to specified address.
CTRL-W	ETB	*	Word skip control function. Moves cursor to the right to first blank character.
CTRL-X	CAN		Transmit contents of storage buffer to (TSC). (See CTRL-Z).
CTRL-Y	EM	*	Erase to end of line. Replaces all characters to the right of cursor with blank characters.
CTRL-Z	SUB	*	Stores contents of edit buffer in storage buffer. Buffer is transmitted as many times as desired to (TSC) by entering CTRL-X.
CTRL-]	GS		Toggle band rate flag between 300 and 1200 baud. Baud rate is then set to new value. Initially baud rate is set to 1200 baud.

EDIT BUFFER DISPLAY VERSUS CONTROL COMMANDS: The figures below will exemplify the control functions that operate on the edit buffer.

THIS IS THE EDIT BUFFER■	The first figure shows the edit buffer containing a line of information typed from the keyboard. Notice that the cursor is positioned to the right of the last character entered.
THIS IS THE EDIT BUFFER	The CTRL-H control function moves the cursor to the beginning of the edit buffer.
THIS IS THE■EDIT BUFFER	CTRL-G was entered eleven times to move the cursor seven character positions to the right. CTRL-W function could have been entered three times to accomplish the same results by skipping over three words.
THIS IS THE■ EDIT BUFFER	CTRL-I was entered to insert blanks into the text.
THIS IS THE VDM■ EDIT BUFFER	Text is then entered.
THIS IS THE■ VDM EDIT BUFFER	CTRL-F is used to move the cursor to the left.
THIS IS THE■ VDM EDIT BUFFER	CTRL-Z is entered to place the contents of the edit buffer in the storage memory. The edit buffer is unchanged. The storage memory can be transmitted to the TSC by entering CTRL-X. CTRL-D is entered four times to delete four characters from the text. Note that the text to the right of the cursor is shifted to the left.
THIS IS THE■	CTRL-Y is used to delete all text to the right of the cursor.
THIS IS TH■	The DEL character is used to delete a character.
■	The character ↑ is used to delete the contents of the edit buffer.
■	CTRL-Q moves the cursor to the next tab position.



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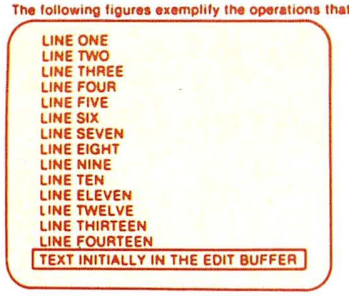
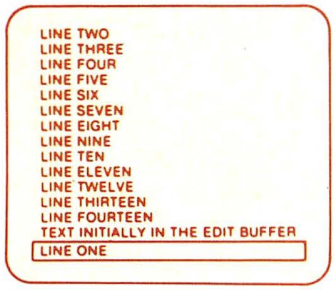
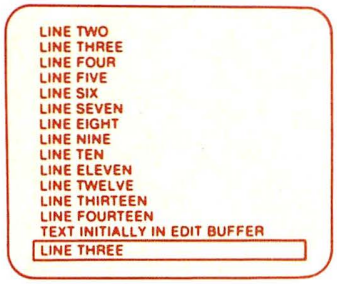
The following figures exemplify the operations that effect the entire display.



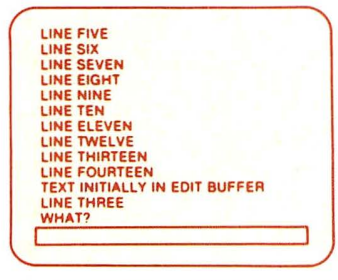
This is the initial display to be operated upon by the control functions.



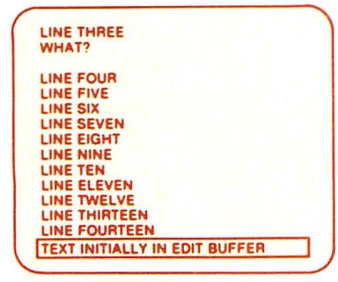
CTRL-K scrolls the entire display up one line. The top line is moved into the edit buffer.



The characters "EE" followed by CTRL-S were entered. The TSC program then searches the display for an occurrence of "EE." These characters were found in the line containing "LINE THREE." The contents of the edit buffer were replaced by this line.



A carriage return was entered and the contents of the edit buffer was transmitted to the TSC. The TSC responds with "WHAT?" The edit buffer is cleared and the display scrolls upward.



CTRL-L is entered three times to scroll the display down three lines. The contents of the editor is transferred to the top line of the display.

SOFTWARE OPERATING SYSTEM. With the exception of the I/O handling operation, the program is fairly straightforward, for it makes use of the daisy chain operation, a technique that involves cascading through each link of the daisy chain checking each status port for possible input and for the output port transmission buffer to be empty, so that if there exists any output, it can be transmitted as required (see Figure 4). Whenever a character is input from a modem, it is immediately displayed on the VDM, and if the terminal output sense switch is on, the character is stored in the terminal output buffer. Characters are not output directly to the modem, for they are stored in a modem output buffer.

When it is determined that the output port transmission buffer is empty, the program checks the corresponding output buffer to determine if it is empty, and if the buffer is not empty, a character is fetched. The program then continues to jump through the various links of the daisy chain and examines input and output status bits. The distinguishing characteristics of a daisy chain type I/O processor is that the program never loops on a single I/O status port.

We should discuss the 256 word-

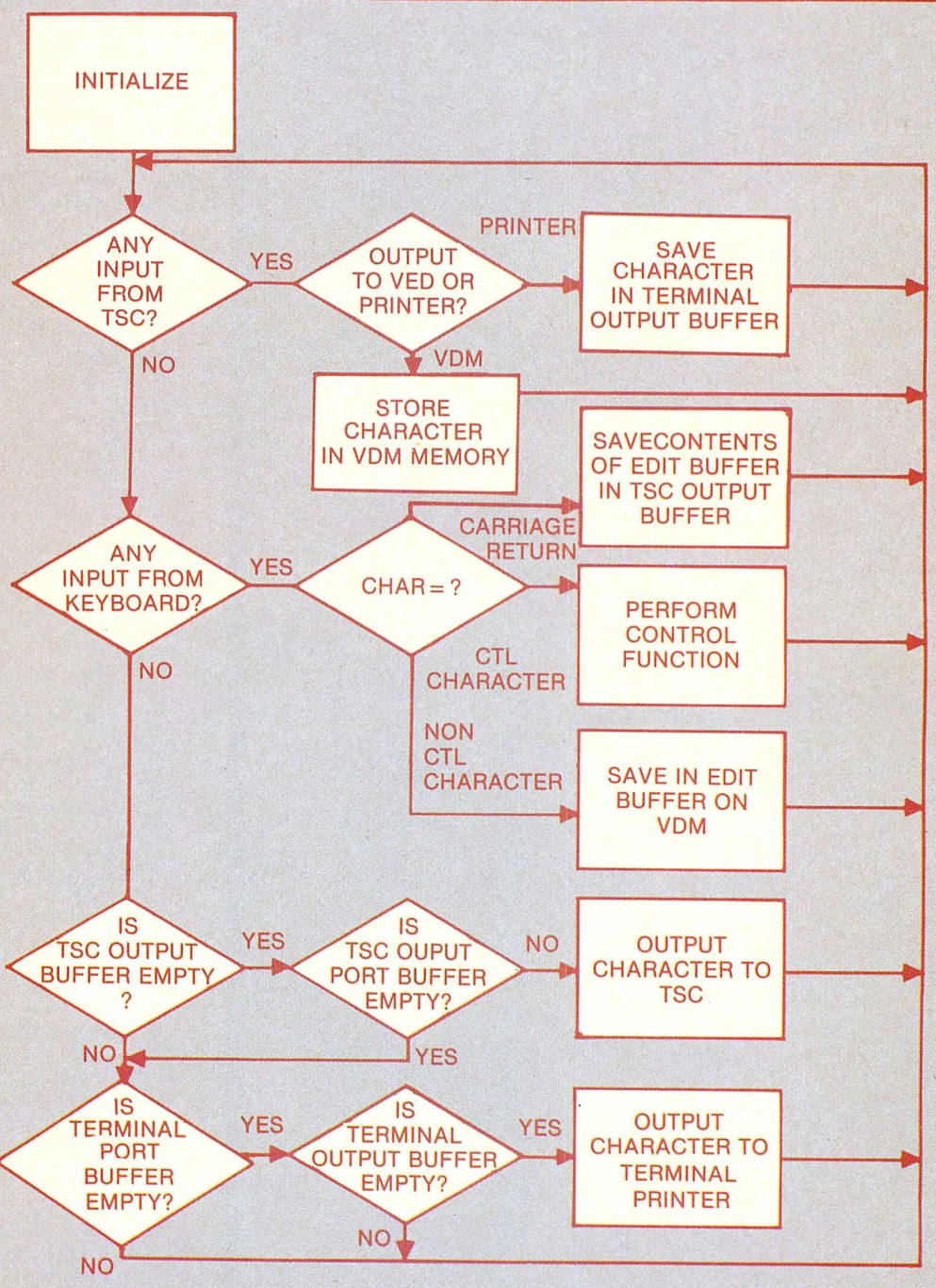


Figure 4. General Flow Diagram for the Intelligent Terminal program that controls the communications between a terminal with keyboard and a printer, a DVM, and a Timesharing Computer (TSC).

output buffers. They are needed because:

1. The baud rates of the modem and terminal may differ.
2. Even with the same baud rate, the timing is not in phase, and this can result in a loss of data.

SOFTWARE OPERATING SYSTEMS — BUFFERS: Two pointers are associated with each output buffer. Initially they both point to the beginning of the buffer. One is called the first character pointer or (FCP); the other is termed the last character pointer (LCP). Each time a character is entered into this buffer, it is stored in the location LCP, and LCP is expanded by one. When it is possible to output a character, and the FCP and LCP do not point to the same location, the character at FCP is output and FCP is increased by one. If both pointers point to the same location, there are no characters to be output, and the buffer is said to be "empty." When one of the pointers reaches the top of the buffer, it is reset to the beginning. Buffers of this type are called circular buffers. An entry from the keyboard is processed as it is entered, and if the entry is not a control function, it is placed in the edit buffer which is in the bottom 128 bytes of the VDM 1024-word memory. The character is displayed with a white background. The cursor is then moved closer to the top of the buffer by one position.

Whereas if the character is a carriage return, the contents of the edit buffer are transferred to the TSC output buffer to be transferred to the TSC.

Other control characters direct the program to execute various straightforward tasks such as:

- Editing
- Scrolling
- Outputting canned messages to the TSC or VDM
- Terminal control functions
- Loading BASIC and object programs transmitted from the TSC

SOFTWARE OPERATING SYSTEM — DEPENDENT PARAMETERS: Certain parameters exist that are dependent upon the system. These values will probably have to be changed before the program can operate on the user's system. The parameters are presented in Table 2 below.

SUMMARY

We have found that this system enhances our communications with a large-scale computer. Consequently, program development on both the micro and maxi computers has become more productive and also more enjoyable. Furthermore, we are continually adding new features in order to make the microcomputer side of the interface even more powerful. With our latest version, we can transfer blocks of data directly from the TSC to a floppy disc, perform editing by using only the microcomputer, and once this is completed, transfer the data back to the TSC for further processing.

SYMBOL	CURRENT VALUE	USAGE
—	5000H	Beginning of program
MONIT	B800H	Prom monitor entry point
ASSM	E060H	Prom assembler entry point
MIO	7	Modem I/O data port
MSTAT	6	Modem I/O status port
KEYS	0	Terminal I/O data port
INBAS	04D8H	Location of MITS 8K Basic 3.1 input routine
BASIC	0	Address to reenter 8K Basic 3.1
TTYBE	2	Bit to check to see if I/O transmission buffer is empty. (Same for all ports)
RDA	1	Bit to check to see if character has been input. (Same for all ports)
STACK	6FF0H	Top of stack pointer
TOP	0CC00H	Beginning of DTV buffer
TOPH	0CC	
MOBUF	DB00	Beginning of 256 word modem output buffer
TOBUF	DA00	Beginning of 256 word terminal output buffer
—	D700H	Origin of data storage area

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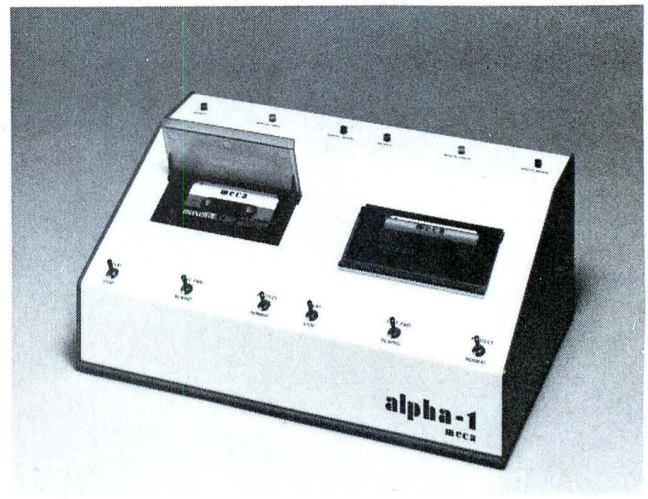

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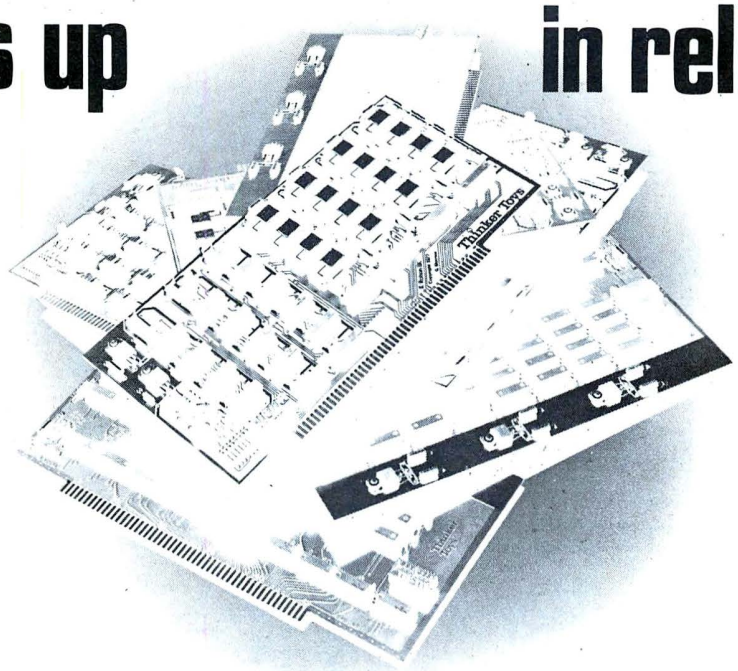
                        ; I-O CONTROL TABLE
                        ;************************** EQUATES ****************************
 0007                   MIO     EQU     7               ;DEM I/O CHANNEL
 0006                   MSTAT   EQU     6               ;
 0001                   RDA     EQU     1               ; DATA AVAILABLE FLAG
 0002                   TTYDE   EQU     2               ; UART TRANSMISSION BUFFER EMPTY FLAG
 00FF                   SENSE   EQU     0FFH
 0000                   KEYS    EQU     0
 0001                   KEYI    EQU     1
 040B                   INBAS   EQU     040BH           ; BASIC INPUT ROUTINE
 0A20                   BLK     EQU     020H
 0A0A                   WALK    EQU     0AH
 0FF0                   STACK   EQU     0FF0H
 0000                   BASIC   EQU     0               ;  BASIC ENTRY POINT
 040D                   OUBAS   EQU     040DH           ; 8K BASIC OUTPUT ROUTINE
 8A00                   MONIT   EQU     08A00H          ; MONITOR
 CC00                   TOP     EQU     0CC00H          ; TOP OF TV SCREEN
 CFB0                   WORDS   EQU     TOP+3B0H        ;
 00CC                   TOPH    EQU     0CCH            ; TOP OF TV SCREEN
 0000                   CR      EQU     13              ;
 000A                   LF      EQU     10              ;
 5000                           ORG     5000H           ;START PROGRAM HERE
                        ;
                        ;     TERMINAL CONTROL FUNCTIONS
                        ;
 5000  C34350           CTAB:   JMP     BEGIN           ;
 5003  FF51                    DW      BREAK           ; NULL = (OR BREAK KEY)
 5005  008A                    DW      MONIT           ; MONITOR
 5007  9851                    DW      MSG2            ; OUTPUT CANNED MESSAGE TWO
 5009  60E0                    DW      0E060H          ; ASSEMBLER
 500B  9352                    DW      CHDEL           ; CTL-D DELETE FROM TEXT
 500D  9251                    DW      MSG1            ; CTL-E 5 OUTPUT CANNED MESSAGE ONE
 500F  7A52                    DW      LEFT            ; CTL-F 6 MOVE CURSOR LEFT
 5011  6E52                    DW      RIGHT           ; CTL-G 7 MOVE CURSOR RIGHT
 5013  8152                    DW      CHOME           ; CTL-H 8 HOME CURSOR
 5015  A352                    DW      MOVE            ; CTL-I 9 INSERT BLANK INTO TEXT
 5017  4C51                    DW      GSTAR           ; LINE FEED =
 5019  C752                    DW      UP              ; CTL-K SCROLL UP
 501B  E652                    DW      DOWN,           ; CTL-L SCROLL DOWN
 501D  0A50                    DW      SAVCR           ; CARRIAGE RETURN
 501F  9753                    DW      BASIO           ; CTL-N 14  TSC- TO- BASIC
 5021  4C51                    DW      GSTAR           ; CTL-O 15
 5023  4C51                    DW      GSTAR           ; CTL-P 16
 5025  5554                    DW      TAB             ; CTL-Q 17 TABS
 5027  EF50                    DW      REPET           ; CTL-R 18 REPRINT LINE
 5029  E053                    DW      FIND            ; CTL-S FIND STRING IN EDIT BUFFER
 502B  4C51                    DW      GSTAR           ; CTL-T 20 -
 502D  8C54                    DW      HELP            ; CTL-U 21 - HELP
 502F  1A53                    DW      READ            ; CTL-V GO READ HEX
 5031  3954                    DW      SKIP            ; CTL-W SKIP OVER WORD
 5033  2354                    DW      SENDW           ; CTL-X TRANSMIT SAVED IMAGE
 5035  EF51                    DW      ERASE           ; CTL-Y ERASE TO LINE OF LINE
 5037  2954                    DW      SAVEM           ; CTL-Z 10 SAVE EDIT BUFFER
 5039  4C51                    DW      GSTAR           ; ESC
 503B  4C51                    DW      GSTAR           ; 28 FS
 503D  6F54                    DW      BAUD            ; 29=GS  300-1200 BAUD TOGGLE
 503F  4C51                    DW      GSTAR           ; 30 RS
 5041  4C51                    DW      GSTAR           ; 31 US
                        ;
                        ;************************** BEGIN ****************************
 5043  31F00F           BEGIN:  LXI     SP,STACK        ; SET STACK POINTER
 5046  11C054                   LXI     D,MASK          ; INITIALIZE RAM AREA
 5049  210007                   LXI     H,TBUF          ; POINT TO 9000H RAM
                        ;
 504C  1A               LOOP:   LDAX    D               ;
 504D  77                       MOV     M,A             ;
 504E  23                       INX     H               ;
 504F  13                       INX     D               ;
 5050  FE0A                     CPI     0DAH            ; END OF MASK
 5052  C24C50                   JNZ     LOOP            ; IF NOT LOOP
 5055  3E00                     MVI     A,0             ;
 5057  D3CB                     OUT     0CBH            ; INITIALIZE  TV CONTROL PORT
 5059  CDDF51                   CALL    SCRL            ; CLEAR TV
 505C  3E03             RESTAR: MVI     A,3             ; TO PORT MASTER RESET
 505E  D306                     OUT     MSTAT           ; INITIALIZE PORT
 5060  3A07D7                   LDA     BRATE           ;  PICK UP CURRENT BAUD RATE
 5063  D306                     OUT     MSTAT           ; 1200 OR 300 BAUD
                        ;
                        ; BLANK OUT EDIT BUFFER
 5065  CDF551          NEWL:   CALL    BLANK           ; BLANK OUT EDIT LINE
 5068  21B0CF                   LXI     H,WORDS         ; POINT TO BEGINNING OF EDIT BUFFER
 506B  0600                     MVI     B,0             ; ZERO OUT CHARACTER COUNT
 506D  220807                   SHLD    POINT           ;  SAVE CURSOR POINTER
                        ;
                        ;   CHECK FOR MODEM INPUT
                        ;
 5070  DB06             START:  IN      MSTAT           ;  0330 CHECK MODEM STATUS
 5072  E601                     ANI     RDA             ; ANY INPUT?
 5074  CA8450                   JZ      INB             ;IF NOT GO CHECK TTY INPUT STATUS
 5077  DB07                     IN      MIO             ; 0360 ACCEPT INPUT FROM MODEM
 5079  E67F                     ANI     7FH             ; DELETE?
 507B  CA7050                   JZ      START           ; REJECT IFM
 507E  CD1651           ST1:    CALL    OUTC            ;OUTPUT TO TV/TTY
 5081  C37050                   JMP     START           ;
                        ;
                        ;
                        ;      ANY INPUT FROM THE KEYBOARD?
                        ;
 5084  DB00             INA:    IN      KEYS            ; 0390 INPUT FROM TTY?
 5086  E601                     ANI     RDA             ;
 5088  CA6B51                   JZ      CHKT            ;IF NOT, GO CHECK TTY OUTPUT STATUS
 508B  DB01                     IN      KEYI            ; 0420 ACCEPT INPUT FROM TTY
 508D  E67F                     ANI     7FH             ;STRIP OFF PARITY BIT
 508F  FE20                     CPI     BLK             ; IS IT CTL CHARACTER?
                        ;
                        ; CHECK CONTROL COMMAND TABLE
                        ;
 5091  217050                   LXI     H,START         ; SAVE RET ADDR ON STACK
 5094  E5                       PUSH    H
 5095  D2A350                   JNC     NOCTL           ; IF NOT GO STORE IT
 5098  210350                   LXI     H,CTAB          ; ADDR OF CMD TABLE
 509B  87                       ADD     A               ; MULTIPLY BY 2
 509C  85                       ADD     L
 509D  6F                       MOV     L,A             ; AND ADD TO HL
 509E  7E                       MOV     A,M             ; PICK UP LOWER ADDR
 509F  23                       INX     H
 50A0  66                       MOV     H,M             ; PICK UP HIGH ADDR
 50A1  6F                       MOV     L,A             ;HL CONTAIN JMP ADDRESS
 50A2  E9                       PCHL
                        ;
 50A3  FE5E             NOCTL:  CPI     94              ;UP ARROW: DELETE LINE
 50A5  CAEB50                   JZ      DELET           ;
 50A8  FE7F                     CPI     127             ;DELETE CHARACTER (RUBOUT)
 50AA  2A0807                   LHLD    POINT
 50AD  C2C550                   JNZ     SAVE            ;GO SAVE CHARACTER IN EDIT BUFFER
 50B0  CD6652                   CALL    WDB             ;
 50B3  2B                       DCX     H               ;DELETE CHARACTER
 50B4  7D                       MOV     A,L             ;
 50B5  FE00                     CPI     00H             ; AT BEGINNING OF LINE?
 50B7  220807                   SHLD    POINT           ;
 50BA  3620             BLANK:  MVI     M,BLK           ;BLANK IT OUT
 50BC  CAFB50                   JZ      DELET           ;IF ZERO, DELETE LINE
 50BF  3E5F                     MVI     A,95            ;OUTPUT UNDERSCORE
 50C1  CDDF51                   CALL    OUTD            ;GO OUTPUT CHARACTER
 50C4  C9                       RET                     ;
                        ;
                        ;   SAVE CHARACTER
                        ;
 50C5  F680             SAVE:   ORI     80H             ;
 50C7  77                       MOV     M,A             ;STORE CHARACTER IN EDIT BUFFER
 50C8  CDDF51                   CALL    OUTD            ;
 50CB  23               INVRH:  INX     H               ;BUMP MEMORY POINTER
                        ;
                        ;   SET UP CURSOR
                        ;
 50CC  7E               INVRC:  MOV     A,M             ;TURN ON CURSOR
 50CD  E67F                     ANI     7FH             ;
 50CF  77                       MOV     M,A             ;
 50D0  220807                   SHLD    POINT           ;
 50D3  C9                       RET                     ;
                        ;
                        ;
                        ;  COME HERE FOR CRLF PROCESSING...
                        ;  OUTPUT EDIT BUFFER TO TSC.
                        ;
 50D4  CDAA52           SAVCR:  CALL    LENG            ;FIND LENGTH
 50D7  3600                     MVI     M,0             ;
                        ;
                        ;
 50D9  21B0CF           OUTI:   LXI     H,WORDS         ;YES, OUTPUT LINE TO BIG COMPUTER
 50DC  7E               OUTX:   MOV     A,M             ;PICK UP CHARACTER
 50DD  E67F                     ANI     7FH             ;
 50DF  CD2752                   CALL    OUT2            ;TRANMIT IT
 50E2  FE00                     CPI     CR              ; END OF LINE?
```

```
50F4  23          INX   H          ;INCREMENT EDIT BUFFER POINTER
50F5  C20C50      JNZ   OUTX       ;LAST CHARACTER?
                  ;
                  ;  DELETE LINE
                  ;
50F8  CD0A51      DELET: CALL  CRLF  ;CLEAR EDIT BUFFER
50FB  F1          NEW:  POP   PSW
50FC  C36550      JMP   NEWL       ;
                  ;
                  ; REPRINT THE LINE
                  ;
50FF              REPET:             ;REPRINT LINE WHEN CTL-R IS ENTERED
50FF  CDAA52      CALL  LENG         ;GET LENGTH OF LINE
5102  78          MOV   A,B
5103  B7          ORA   A            ;IS EDIT BUFFER EMPTY?
5104  3204D7      STA   COUNT        ;NO
5107  C8          RZ                 ;IF SO, GO TO START
5108  2180CF      LXI   H,WORDS      ;ELSE, POINT TO BEGINNING OF BUFFER
510B  CD0A51      CALL  CRLF         ;OUTPUT CARRIAGE RETURN-LINE FEED
510E  7E          REPA: MOV   A,M    ;REPRINT WHOLE LINE
510F  E67F        ANI   7FH          ;
5111  CD1651      CALL  OUTC         ;
5114  23          INX   H            ;BUMP POINTER
5115  05          DCR   B            ;DECREMENT CHARACTER COUNT
5116  C2FE50      JNZ   REPA         ;LOOP
5119  C9          RET
                  ;
                  ;  OUTPUT CARRIAGE RETURN -- LINE FEED (AND NULLS)
                  ;
510A  0E0D        CRLF: MVI   C,CR   ;OUTPUT CARRIAGE RETURN LINE FEED
510C  C32451      JMP   OUTCR        ;
                  ;
                  ;  OUTPUT TO CONSOLE
                  ;
510F  4F          OUTD: MOV   C,A    ;MORE CRLF KLUDGE
5110  DBFF            IN    SENSE    ; 1040 CHECK SENSE SWITCHES
5112  E601            ANI   1        ;IS S/W 8 ON?
5114  79              MOV   A,C      ;
5115  C0              RNZ            ;IF NOT,  RETURN OUTPUT NO CHARACTER
                  ;
                  ;    OUTPUT ONE CHARACTER
                  ;
5116  E67F        OUTC: ANI   7FH    ;
5118  FE7F            CPI   7FH      ;DEL?
511A  C8              RZ             ;
511B  4F              MOV   C,A      ;
511C  FE20            CPI   BLK      ;CR?
511E  D22951          JNC   NOCR     ;NO CTL BUT COULD BE CR
5121  FE0D            CPI   CR       ;IS IT CR?
5123  C0              RNZ            ;NOPE, THEN IGNORE
5124  3A06D7    OUTCR:  LDA   LASTC    ;OUTPUT CARRIAGE ROUTINE
5127  B9              CMP   C        ;IF PREVIOUS CHARACTER WAS NOT CARRI
5128  C8              RZ             ;RETURN IF LAST CHAR WAS CR
5129              NOCR:
5129  DBFF            IN    SENSE    ;
512B  E601            ANI   1        ;SW-8 ON?
512D  79              MOV   A,C      ;
512E  3206D7          STA   LASTC    ;SAVE IN 'LAST' CHARACTER BUFFER
5131  C23352          JNZ   CHOUT
5134  CD4051          CZ    TOUT     ;IF S-W 8 IS OFF, THEN OUTPUT TO TTY
5137  FE0D            CPI   CR       ;
5139  C0              RNZ            ;IF NOT CR, RETURN
513A  3E0A            MVI   A,LF     ;ELSE, OUTPUT LINE-FEED AND 6 NULLS
513C  CD5151          CALL  TOUT1    ;
513F  3E00            MVI   A,0      ;NULL IS ZERO
5141  0E05            MVI   C,5      ;LIKE 6 TIMES
5143  CD5151    NULL:  CALL  TOUT1    ;
5146  0D              DCR   C        ;
5147  C24351          JNZ   NULL     ;
514A  3E0D            MVI   A,CR     ;RESTORE CR TO A-REG
514C  C9        GSTAR: RET            ;(JUMP HERE FOR UNDEFINED CMDS)
                  ;
                  ;    BUFFER OUTPUT ROUTINE
                  ;
514D  79        TOUT:  MOV   A,C      ;
514E  3206D7           STA   LASTC    ;SAVE IN 'LAST' CHARACTER BUF
5151            TOUT1:                 ;NOW, OUTPUT TO TTY
5151  EB              XCHG
5152  2A00D7          LHLD  ERUF     ;LOAD D-REG WITH POINTER TO LAST CHA
5155  77              MOV   M,A      ;SAVE CHARACTER IN TTY OUTPUT BUFFER
5156  CD5E51          CALL  LIMCHK
5159  2200D7          SHLD  ERUF
515C  EB              XCHG
515D  C9              RET            ;
                  ;
                  ;  CHECK LIMITS OF OUTPUT BUFFER
                  ;  VARIES FROM 9000H TO 9FFFH
                  ;
515E  23        LIMCHK: INX   H
515F  F5                PUSH  PSW
5160  7C                MOV   A,H
5161  FEA0              CPI   0A0H     ; DON'T LET IT EXCEED 9FFF
5163  C26951          JNZ   LIM1
5166  210090          LXI   H,9000H    ; RESET 4096 BYTE CIRCULAR BUFFER
5169  F1        LIM1:   POP   PSW      ; RESTORE A
516A  C9                RET
                  ;
                  ;   IF TBE AND TTY BUFFER NOT EMPTY, THEN OUTPUT A CHARACTER TO TTY
                  ;
516B  DB00        CHKT:   IN    KEYS     ; 1450 IS TTY TRANSMISSION BUFFER EMPTY (
516D  E602              ANI   TTYBE    ;(TBE STATUS = 00000010B)
516F  CA0952            JZ    MOUT     ;NO, THEN GO CHECK MODEM OUTPUT STAT
5172  3A02D7            LDA   SBUF     ;START OF TTY OUTPUT BUF
5175  2A00D7            LHLD  ERUF     ;LOAD H-L REG WITH POINTER TO TTY OU
5178  BD                CMP   L        ;DOES LAST CHAR, POINT TO FIRST CHAR
5179  C28351            JNZ   CHKT1    ;IF SO, THEN THERE IS NO CHAR TO BE
517C  3A0307            LDA   SBUF+1   ;
517F  BC                CMP   H
5180  CA0952            JZ    MOUT
5183  3A02D7    CHKT1:  LHLD  SBUF
5186  7E                MOV   A,M      ;PICK UP CHARACTER FROM BUFFER
5187  D301              OUT   KEY1     ;OUTPUT IT TO TTY
5189  CD5E51            CALL  LIMCHK   ;INCREMENT STARTING CHARACTER BUFFER
518C  2202D7            SHLD  SBUF
518F  C37050            JMP   START    ;
                  ;
                  ; OUTPUT CANNED MESSAGE ONE
                  ;
5192  110D54    MSG1:   LXI   D,SMSG   ;OUTPUT CANNED MESSAGE
5195  C39E51            JMP   OUTMG    ;
                  ;
                  ;
                  ;    OUTPUT SUBS MESSAGE
                  ;
5198  11CA54    MSG2:   LXI   D,UMSG   ;OUTPUT CANNED MESSAGE TWO
519B  C39E51            JMP   OUTMG    ;
519E  DB06      OUTMG:  IN    MSTAT    ; 1670 ROUTINE TO OUTPUT MESSAGE AT ADDRE
51A0  E602              ANI   TTYBE    ;CHECK STATUS
51A2  CA9E51            JZ    OUTMG    ;LOOP IF TRANSMISSION BUF NOT EMPTY
51A5  1A                LDAX  D        ;PICK UP CHARACTER
51A6  CD0052            CALL  JOUT     ;AND OUTPUT IT
51A9  E67F              ANI   7FH      ;
51AB  FE0D              CPI   CR       ;IS IT A CARRIAGE RETURN?
51AD  13                INX   D        ;INCREMENT CHAR POINTER
51AE  C8                RZ             ;
51AF  C39E51            JMP   OUTMG    ;OUTPUT NEXT CHARACTER
                  ;
                  ;  SCROLL UP ONE LINE
                  ;
51B2  060D      SCRL:   MVI   B,CR     ;SCROLL UP ONE LINE
51B4  2100CC    SCRLX:  LXI   H,TOP    ;TO ADDRESS
51B7  1140CC            LXI   D,TOP+40H ;FROM ADDRESS
51BA  CDC151            CALL  SCUP     ;SCROLL UP ONE LINE
51BD  CDE351            CALL  ZERO     ;BLANK OUT LINE 3
51C0  C9                RET            ;
                  ;
                  ;  SCROLL UP
                  ;
51C1  0E40      SCUP:   MVI   C,64     ;SCROLL UP ONE LINE
51C3  1A        SCUP2:  LDAX  D        ;PICK UP CHARACTER
51C4  E67F              ANI   7FH      ;STRIP OFF WHITE BACKGROUND
51C6  77                MOV   M,A      ;STORE IT IN NEW LOCATION
51C7  23                INX   H        ;ADJUST POINTERS
51C8  13                INX   D        ;
51C9  0D                DCR   C        ;DECREMENT CHARACTER COUNTER
51CA  C2C351            JNZ   SCUP2    ;LOOP
51CD  05                DCR   B        ;DECREMENT LINE COUNTER
51CE  C2C151            JNZ   SCUP     ;
51D1  C9                RET            ;
                  ;
                  ;    SCROLL DOWN ONE LINE
                  ;
51D2  0E40      SCDN:   MVI   C,64     ;SCROLL DOWN ONE LINE
51D4  1A        SCDN2:  LDAX  D        ;PICK UP CHARACTER
51D5  E67F              ANI   7FH      ;REMOVE WHITE BACKGROUND
51D7  77                MOV   M,A      ;STORE CHARACTER IN NEW LOCATION
51D8  2B                DCX   H        ;DECREMENT POINTERS
51D9  1B                DCX   D        ;
51DA  0D                DCR   C        ;AND CHARACTER COUNTER
51DB  C2D451            JNZ   SCDN2    ;LOOP FOR ALL 64 CHARACTERS
51DE  05                DCR   B        ;DECREMENT LINE COUNTER
51DF  C2D251            JNZ   SCDN     ;
51E2  C9                RET            ;
```

Now low-cost memory stacks up in reliability!



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                        ;
                        ;  BLANK OUT ONE LINE
                        ;
51E3  3E20      ZERO:   MVI     A,' '           ;LOAD A-REG WITH BLANK CHARACTER
51E5  0E40              MVI     C,64            ;LINE CHARACTER COUNT
51E7  77        SC3:    MOV     M,A             ;STORE BLANK
51E8  23                INX     H               ;
51E9  0D                DCR     C               ;
51EA  C2E751            JNZ     SC3             ;LOOP FOR ALL 64 CHARACTERS
51ED  C9                RET                     ;
                        ;
                        ;  ERASE TO END OF LINE
                        ;
51FE  2A0AD7    ERASE:  LHLD    POINT           ; PICK UP POINTER TO CURSOR
51F1  23                INX     H               ;
51F2  C3E751            JMP     BLKA            ;
                        ;
                        ;  BLANK OUT LINE
                        ;
51F5  2180CF    BLANK:  LXI     H,WORDS         ; POINT TO BEGINNING OF EDIT BUF
51FA  3E40      BLKA:   MVI     A,' '+BLK       ;WHITE BACKGROUND TYPE
51FA  0F80              MVI     C,128           ;BLANK OUT LOWER TWO LINES
51FC  C3E751            JMP     SC3             ;
                        ;
                        ;  PERFORM IMMEDIATE BREAK FUNCTION
                        ;
51FF  AF        BREAK:  XRA     A               ;
                        ;
                        ; SET PARITY EVEN AND OUTPUT TO MODEM
                        ;
5200  B7        JOUT:   ORA     A               ; SET ARRO FLAGS
5201  EA0652            JPE     JOUTA           ; IS PARITY EVEN?
5204  F680              ORI     80H             ; IF NOT SET PARITY BIT EVEN
5206  D307        JOUTA:  OUT     MIO             ; OUTPUT TO MODEM
5208  C9                RET                     ;
                        ;
                        ;  OUTPUT BUFFER TO MODEM
                        ;
5209  DB06      MOUT:   IN      MSTAT           ; CHECK STATUS BIT
520B  E602              ANI     TTYRE           ;
520D  CA7050            JZ      START           ;GO CHECK FOR INPUT FROM BIG COMPUTE
5210  3A0ED7            LDA     MBUF            ;CURRENT CHARACTER POINTER
5213  2A0CD7            LHLD    MBUF            ;LAST CHARACTER OUTPUT POINTER
5216  BD                CMP     L               ;
5217  CA7050            JZ      START           ; RETURN IF THERE ARE NO CHARACTERS
521A  6F                MOV     L,A             ; 250  TO BE OUTPUT! ELSE OUTPUT CHARACTE
521B  7E                MOV     A,M             ;
521C  CD0052            CALL    JOUT            ;
521F  2C                INR     L               ;INCREMENT CURRENT CHAR POINTR
5220  7D                MOV     A,L             ;
5221  320ED7            STA     MBUF            ;
5224  C37050            JMP     START           ; 2310
                        ;
                        ;    OUTPUT TO MODEM
                        ;
5227                    OUT7:                   ;
5227  E5                PUSH    H               ;
5228  2A0CD7            LHLD    MBUF            ;POINTER TO LAST CHAR OUTPUT
522B  E67F              ANI     7FH             ;
522D  77                MOV     M,A             ;SAVE CHARACTER IN OUTPUT BUFFER
522E  2C                INR     L               ;
522F  220CD7            SHLD    MBUF            ;
5232  E1                POP     H               ;
                        ;
5233  E5        CHOUT:  PUSH    H               ;
5234  4F                MOV     C,A             ; SAVE CHARACTER
5235  C5                PUSH    B               ;
5236  2A0AD7            LHLD    TVBUF           ;TV BUFFER CURRNET CHARACTER POINTER
5239  E67F              ANI     7FH             ;
523B  FE0D              CPI     CR              ;IS IT CR?
523D  CA5452            JZ      TVCR            ;IF SO, THEN SCROLL UP
5240  FE5F              CPI     95              ;ELSE CHECK FOR DELETE
5242  C24952            JNZ     CH0             ;
5245  2B                DCX     H               ;IF CHAR IS DELETE, MOVE POINTER BA
5246  C35F52            JMP     CH2             ;
5249  FE20      CH0:    CPI     BLK             ;IS CHAR CONTROL TYPE?
524B  DA6252            JC      CHEND           ;IF NOT, OUTPUT CHARACTER TO TV
524E  7D                MOV     A,L             ;ELSE, RETURN IF NOT CR
524F  FE80              CPI     80H             ;
5251  C25D52            JNZ     CH1             ;
5254  CD8251    TVCR:   CALL    SCRL            ;SCROLL UP ONE LINE
5257  2140CF            LXI     H,TOP+340H      ;RESET EDIT BUFFER
525A  C35F52            JMP     CH2             ;
525D  71        CH1:    MOV     M,C             ;NOW, FINALLY, SAVE CHAR IN
525E  23                INX     H               ;IN BUFFER AND BUMP POINTER
525F  220AD7    CH2:    SHLD    TVBUF           ;SAVE POINTER
5262  C1        CHEND:  POP     B               ;
5263  E1                POP     H               ; RESTORE H AND L
5264  79                MOV     A,C             ;
5265  C9                RET                     ;
                        ;
                        ; RESET CURRENT CURSOR POSITION
5266  2A0BD7    WOR:    LHLD    POINT           ; MODIFY CURSOR
5269  7E                MOV     A,M             ;ERASE CURSOR
526A  F680              ORI     80H             ;
526C  77                MOV     M,A             ;
526D  C9                RET                     ;
                        ;
                        ; MOVE CURSOR RIGHT
                        ;
526E  CD6652    RIGHT:  CALL    WOR             ;MOVE CURSOR RIGHT
5271  C3C850            JMP     INVRH           ;V7 GO INX H AND TURN ON CURSOR
                        ;
                        ;  MOVE EDIT BUFFER LEFT
                        ;
5274  CD6652    LEFT:   CALL    WOR             ;MOVE LEFT ONE POSITION
5277  2B                DCX     H               ;
5278  7D                MOV     A,L             ; AT BEGINNING OF FILE?
5279  FE80              CPI     80H             ;
527B  DA8A52            JC      HOME            ; RESET TO BEGINNING OF BUF
527E  C3CC50            JMP     INVRC           ;
                        ;
                        ;   MOVE CURSOR TO BEGINNING OF EDIT BUFFER
                        ;
5281  CD6652    CHOME:  CALL    WOR             ;
5284  2180CF    HOME:   LXI     H,WORDS         ;HOME CURSOR
5287  C3CC50            JMP     INVRC           ;
                        ;
                        ; ROUTINE TO FIND END OF STRING
                        ;
528A  0680      LENG:   MVI     B,128           ;START AT END OF EDIT BUFFER
528C  21FFCF            LXI     H,WORDS+127     ;127
528F  7E        LENGA:  MOV     A,M             ;
5290  FEA0              CPI     WALK            ;IS IT BLANK?
5292  CA9A52            JZ      LENGC           ;
5295  FE20              CPI     BLK             ;
5297  C29F52            JNZ     LENGB           ;
529A  2B        LENGC:  DCX     H               ;LOOK AT NEXT CHARACTER
529B  05                DCR     B               ;
529C  C28F52            JNZ     LENGA           ;
529F  23        LENGB:  INX     H               ;END OF IMAGE HAS BEEN FOUND
52A0  3620              MVI     M,WBLK          ;SET CURSOR
52A2  C9                RET                     ;
                        ;
                        ;  CTL-I  INSERT INTO TEXT
                        ;
52A3  CD6652    MOVE:   CALL    WOR             ;
52A6  3EFF              MVI     A,0FFH          ;
52A8  1620              MVI     D,BLK           ;
52AA  4E        MOVEL:  MOV     C,M             ;PICK UP  CHARACTER
52AB  72                MOV     M,D             ;STORE PREVIOUS CHARACTER
52AC  51                MOV     D,C             ;
52AD  23                INX     H               ;POINT TO NEXT CHARACTER
52AE  BD                CMP     L               ;END OF EDIT BUFFER?
52AF  C8                RZ                      ;
52B0  C3AA52            JMP     MOVEL           ;IF NOT, THEN CONTINUE
                        ;
                        ;   DELETE IN  TEST CTL-D
                        ;
52B3  2A0BD7    CHDEL:  LHLD    POINT           ;
52B6  7D                MOV     A,L             ;
52B7  16A0              MVI     D,WBLK          ;
52B9  2EFF              MVI     L,0FFH          ;
52BB  4E        CHDHL:  MOV     C,M             ;PICK UP CHARACTER
52BC  72                MOV     M,D             ;STORE LAST CHARACTER
52BD  51                MOV     D,C             ;
52BE  BD                CMP     L               ;LAST CHARACTER IN EDIT BUFFER?
52BF  2B                DCX     H               ;NO, THEN LOOP
52C0  C2BB52            JNZ     CHDHL           ;
52C3  23                INX     H               ;YES, THEN SET CURSOR AND RETURN
52C4  C3CC50            JMP     INVRC           ;
52C7  0601      UP:     MVI     B,1             ;
52C9  1100CC            LXI     D,TOP           ;MOVE TOP LINE TO TEMP BUFFER
52CC  211007            LXI     H,XBUF          ;
52CF  CDC151            CALL    SCUP            ;
52D2  060C              MVI     B,12            ;NOW, SCROLL 14 LINES UP ONE
52D4  CDA951            CALL    SCRLX           ;
52D7  111007            LXI     D,XBUF          ;MOVE TEMP LINE TO EDIT BUFFER

52DA  2180CF            LXI     H,WORDS         ;
52DD  0601              MVI     B,1             ;
52DF  CDC151            CALL    SCUP            ;
52E2  0E40      ENDSC:  MVI     C,64            ;
52E4  2180CF            LXI     H,WORDS         ;
52E7  7E        INVRT:  MOV     A,M             ;TURN ON WHITE BACKGROUND
52E8  F680              ORI     80H             ;
52EA  77                MOV     M,A             ;
52EB  23                INX     H               ;
52EC  0D                DCR     C               ;
52ED  C2E752            JNZ     INVRT           ;LOOP FOR ALL CHARACTERS IN LINE
52F0  CD8A52            CALL    LENG            ;GO COMPUTE IMAGE LENGTH
52F3  C37050            JMP     START           ;
52F6  0601      DOWN:   MVI     B,1             ;
52F8  11FFCF            LXI     D,WORDS+63      ;3
52FB  214FD7            LXI     H,XBUF+63       ;
52FE  CDD251            CALL    SCDN            ;MOVE EDIT BUFFER TO TEMPORARY BUFFE
5301  117FCF            LXI     D,WORDS-1       ;
5304  218FCF            LXI     H,WORDS+63      ;3
5307  060E              MVI     B,14            ;
5309  CDD251            CALL    SCDN            ;NOW, SCROLL DOWN 14 LINES
530C  114FD7            LXI     D,XBUF+63       ;
530F  213FCC            LXI     H,TOP+63        ;
5312  0601              MVI     B,1             ;
5314  CDD251            CALL    SCDN            ;NOW MOVE TEMPORARY BUFFER TO TOP LI
5317  C3E252            JMP     ENDSC           ;
                        ;
                        ;   READ HEX INPUT INTO MEMORY
                        ;
                        ;
                        ;
                        ; LOAD INTEL HEX OBJECT FROM TSC TO MEMORY
                        ;
531A                    READ:
531A  210000            LXI     H,0             ;SET BIAS ADDRESS TO ZERO
531D  E5                PUSH    H               ;
531E  063A              MVI     B,':'           ;
5320  90                SUB     B               ;
5321  C21A53            JNZ     READ            ;SEARCH FOR COLON
5324  57                MOV     D,A             ;ZERO OUT CHECKSUM
5325  CD5C53            CALL    BYTE            ;
5328  CA4853            JZ      RED2            ;ZERO RECORD LENGTH, ALL DONE
532B  5F                MOV     E,A             ;E (= RECORD LENGTH
532C  CD5C53            CALL    BYTE            ;GET MSB OF LOAD ADDRESS
532F  F5                PUSH    PSW             ;SAVE IT
5330  CD5C53            CALL    BYTE            ;GET LSB OF LOAD ADDRESS
5333  C1                POP     B               ;RETRIEVE MSB, PUT IN B
5334  4F                MOV     C,A             ;
5335  09                DAD     B               ;BIAS ADDRESS + LOAD ADDRESS =1 HL
5336  CD5C53            CALL    BYTE            ;RECORD TYPE
5339                    RED1:
5339  CD5C53            CALL    BYTE            ;READ DATA
533C  77                MOV     M,A             ;PUT IN MEMORY
533D  23                INX     H               ;
533E  1D                DCR     E               ;
533F  C23953            JNZ     RED1            ;LOOP UNTIL DONE
5342  CD5C53            CALL    BYTE            ;READ CHECKSUM
5345  C2A853            JNZ     CHKERR          ;CHECKSUM ERROR
5348  C31A53            JMP     READ            ;GET ANOTHER RECORD
534B                    RED2:
534B  CD5C53            CALL    BYTE            ;GET MSB OF TRANSFER ADDRESS
534E  67                MOV     H,A             ;
534F  CD5C53            CALL    BYTE            ;
5352  6F                MOV     L,A             ;
5353  B4                ORA     H               ;
5354  CA5853            JZ      RED3            ;IF TRANSFER ADDRESS = 0, RETURN TO KB
5357  E9                PCHL                    ;
5358                    RED3:
5358  E1                POP     H               ;
5359  C38453            JMP     READ4           ;
                        ;
535C                    BYTE:
535C  CDA153            CALL    BASIN           ;READ CHAR FROM TAPE
535F  CD7353            CALL    DIGIT           ;CONVERT ASCII TO HEX
5362  07                RLC                     ;
5363  07                RLC                     ;
5364  07                RLC                     ;
5365  07                RLC                     ;SHIFT FOUR PLACES
5366  4F                MOV     C,A             ;
5367  CDA153            CALL    BASIN           ;
536A  CD7353            CALL    DIGIT           ;GET LOWER NIBBLE
536D  B1                ORA     C               ;
536E  4F                MOV     C,A             ;
536F  82                ADD     D               ;UPDATE CHECKSUM
5370  57                MOV     D,A             ;
5371  79                MOV     A,C             ;
5372  C9                RET                     ;RETURN
                        ;
                        ; CONVERT ASCII CHARACTER TO HEX DIGIT
                        ;
5373                    DIGIT:
5373  D630              SUI     '0'             ;
5375  D8                RC                      ; FILTER OUT 0-2FH
5376  C6F9              ADI     '0'+-'0'        ;
5378  D8                RC                      ; FILTER OUT 47H-0FFH
5379  C606              ADI     6               ;
537B  FA8053            JM      NI0             ; TAKE BRANCH FOR A-F
537E  C607              ADI     7               ;
5380  D8                RC                      ; FILTER OUT 3AH-40H
5381                    NI0:
5381  C60A              ADI     10              ;
5383  B7                ORA     A               ; ZERO OUT ERROR FLAG
5384  C9                RET                     ; RETURN
                        ;
                        ;  OUTPUT FINISHED MESSAGE
                        ;
5385  115D55    READ4:  LXI     D,FINMSG        ;
5388  C38E53            JMP     READ5           ;
                        ;
                        ; OUTPUT ERROR MESSAGE
                        ;
538B  114D55    CHKERR: LXI     D,CKMSG         ;
538E  CD8F54    READ5:  CALL    TVMSG           ;
5391  31F00F            LXI     SP,STACK        ;
5394  C36550            JMP     MEML            ;
                        ;
                        ;    BASIC INPUT ROUTINE
                        ;    INPUTS  TSC PROGRAM DIRECTLY TO BASIC
5397                    BASIO:
5397  3A0804            LDA     INBAS           ;
539A  3250D7            STA     TRUF            ;  IN TEMP BUFFER
539D  2A0904            LHLD    INBAS+1         ;  CHANGE BASIC INPUT ROUTINE
53A0  2251D7            SHLD    TRUF+1          ;  SAVE OLD VALUE
53A3  3EC3              MVI     A,0C3H          ;  SAVE JUMP TO NEW ROUTINE
53A5  320804            STA     INBAS           ;
53A8  215353            LXI     H,BASIN         ;
53AB  220904            SHLD    INBAS+1         ;
53AE  C30000            JMP     BASIC           ;  NOW GO TO BASIC
                        ;
                        ;    MODEM TO BASIC ROUTINE
                        ;
53B1                    BASIN:
53B1  DB06              IN      MSTAT           ;
53B3  E601              ANI     1               ;
53B5  CABB53            JZ      KEYIN           ;  GO CHECK KEYBOARD
53B8  DB07              IN      MIO             ;
53BA  C9                RET                     ;
                        ;
53BB                    KEYIN:                  ;  CHECK FOR KEYIN
53BB  DB00              IN      KEYS            ;
53BD  E601              ANI     1               ;
53BF  CAB153            JZ      BASIN           ;  NO INPUT -- GO CHECK MODEM
53C2  DB01              IN      KEYI            ;
53C4  E67F              ANI     7FH             ;  STRIP OFF PARITY
53C6  FE01              CPI     1               ;  CHECK FOR CTL-A
53C8  C2D153            JNZ     BASIN           ;
53CB  FE02              CPI     2               ;  IF CTL-B, THEN GO TO BASIC
                        ;
                        ;    END OF INPUT -- RESET EVERYTHING
                        ;
53CD  3A5D07            LDA     TRUF            ;  RESTORE BASIC NORMAL INPUT
53D0  320804            STA     INBAS           ;
53D3  2A5107            LHLD    TRUF+1          ;
53D6  220904            SHLD    INBAS+1         ;
53D9  CA9006            JZ      BASIC           ;
53DC  C34350            JMP     BEGIN           ;
                        ;
53DF  C9                RET                     ;
                        ;
                        ;    FIND VALUE ON SCREEN
                        ;
53E0  CDA452    FIND:   CALL    LENG            ; GET IMAGE LENGTH
53E3  2100CC            LXI     H,TOP           ;
53E6  221007            SHLD    XBUF            ; XBUF CONTAINS ADDRESS OF TV SCREEN
53E9  4E        FINDA:  MOV     C,M             ; SAVE CHARACTER COUNT
53EA  1180CF            LXI     D,WORDS         ; POINT D-REG TO START OF EDIT BUF
53ED  1A        FINDB:  LDAX    D               ; COMPARE FR STRING CHARACTER
53EE  E67F              ANI     7FH             ;
53F0  BE                CMP     M               ; WITH CHARACTER ON SCREEN
53F1  C2F053            JNZ     FINDC           ; IF NOT FOUND, LOOK AT NEXT TV BUF C
53F4  23                INX     H               ; ELSE, COMPARE NEXT TWO CHARACTERS
53F5  13                INX     D               ;
53F6  0D                DCR     C               ; IF LAST CHAR IN  FR, THEN SEARCH SU
53F7  CA1354            JZ      FOUND           ; AND JUMP TO FOUND
53FA  C3ED53            JMP     FINDB           ; ELSE, COMPARE NEXT TWO CHARACTERS
53FD  2A1007    FINDC:  LHLD    XBUF            ; CONTINUE SEARCH
5400  23                INX     H               ;
5401  221007            SHLD    XBUF            ;
5404  7C                MOV     A,H             ;
5405  FECF              CPI     TOP+3           ;
5407  DAE953            JC      FINDA           ;
540A  7D                MOV     A,L             ;
```
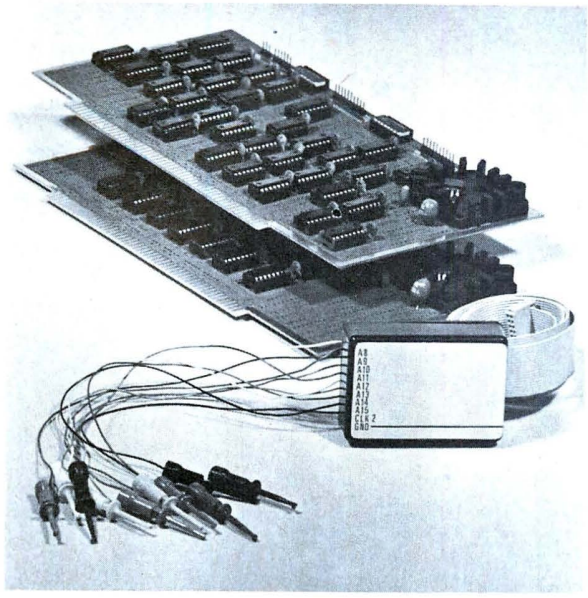
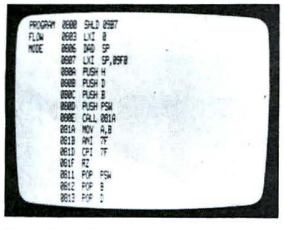

24 channel Logic Analzer plugs into your S-100 Bus



24 Channel **LOGIC ANALYZER**, complete with 2 cards and 3 sets of probes (only one set shown).

Features

- 24 channels with 256 samples each.
- Display of disassembled program flow.
- Dual mode operation — external mode analyses any external logic system. Internal mode monitors users data and address bus.
- Selectable trigger point anywhere in the 256 samples.
- 0-16 bit trigger word format or external qualifier.
- 10MHz sample rate (50ns min. pulse width)
- Synchronous clock sample with coincident or delayed clock mode.
- User defined reference memory.
- Displays and system control through keyboard entry.
- TTL Logic level compatible (15 pf and 15 μa typical input loading).
- Includes annotated source listing.



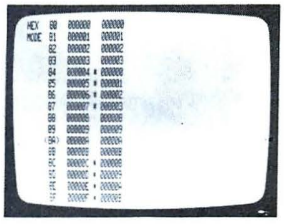
Display of disassembled program flow.

The DATALYZER

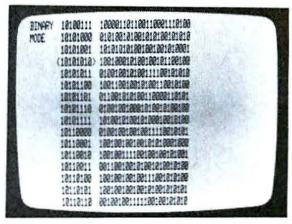
The Databyte Logic Analyzer (DATALYZER) is a convenient, flexible, high quality device. Efficient engineering has allowed a combination of features previously available in only the most expensive units.

Designed to plug easily into your S-100 Bus, the DATALYZER is a complete system —- for only $495. Display of disassembled program flow is a standard feature, not an extra. And the low price includes 30 logic probes, so you can hook up immediately, without additional expense.

The DATALYZER is available in kit form ($495), and as a fully assembled device on two PCB's ($595). Four-week delivery, a substantial warranty, and the Databyte, Inc. commitment to service make the DATALYZER a worthwhile investment. Begin debugging by sending the coupon now.



Displays in Hex



Displays in Binary

Please send me the 24 Channel **LOGIC ANALYZER**

☐ Kit — (manual included) $495.00 (Wis. res. add 4%)

☐ Assembled and Tested (manual included) $595.00

☐ Operators' manual only $7.50

Delivery of all items in four weeks to:

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City_____ State _____ Zip_____

Telephone _____

Payment Enclosed: ☐ Check ☐ Money Order

☐ BankAmericard ☐ Master Charge Exp. Date_____

Number _____

Signature _____

Databyte, Inc.

P.O. Box 14 A
7433 Hubbard Avenue
Middleton, Wisconsin 53562
Tel: (608) 831-7666

```
692  540B  FEA0          CPI     80H             ;
693  540D  DAE953        JC      FINDA           ;
694  5410  C3EB50        JMP     NEW             ;
695  5413  3EC0    FOUND: MVI     A,0C0H          ; SEARCH SUCCESSFUL.  MOVE LINE
696  5415  A5            ANA     L               ; TO EDIT BUFFER
697  5416  6F            MOV     L,A             ;
698  5417  EB            XCHG                    ;
699  5418  21A0CF        LXI     H,WORDS         ;
700  541B  0601          MVI     B,1             ;
701  541D  CDC151        CALL    SCUP            ;
702  5420  C3E252        JMP     ENDSC           ;
703                     ;
704                     ;  SEND TRUF MESSAGE TO MODEM
705                     ;
706  5423  1150D7  SENDM: LXI     D,TBUF          ;
707  5426  C39E51        JMP     OUTMG           ;
708  5429  2150D7  SAVEM: LXI     H,TBUF          ;
709  542C  1180CF        LXI     D,WORDS         ;
710  542F  0601          MVI     B,1             ;
711  5431  CDC151        CALL    SCUP            ;
712  5434  360D          MVI     M,CR            ;
713  5436  C38A52        JMP     LENG            ;
714                     ;
715                     ;  CTL-W = SKIP TO NEXT WORD
716                     ;
717  5439  2A0BD7  SKIP:  LHLD    POINT           ;
718  543C  7E      SKIPA: MOV     A,M             ;
719  543D  F680          ORI     80H             ;
720  543F  77            MOV     M,A             ;
721  5440  23            INX     H               ;
722  5441  7C            MOV     A,H             ;
723  5442  FED0          CPI     TOPH+4H         ;
724  5444  D28A52        JNC     HOME            ;
725  5447  7E            MOV     A,M             ;
726  5448  FE20          CPI     BLK             ;
727  544A  CACC50        JZ      INVRC           ;
728  544D  FEA0          CPI     WRLK            ;
729  544F  C23C54        JNZ     SKIPA           ;
730  5452  C3CC50        JMP     INVRC           ;
731                     ;
732                     ; DO TAB THING (CTL-Q)
733                     ;
734  5455  CD6652  TAB:   CALL    WOP             ; LOAD CURSOR POINTER
735  5458  3E4B          MVI     A,4BH           ;
736  545A  FE00    TABA:  CPI     0               ;
737  545C  CA8A52        JZ      HOME            ;
738  545F  BD            CMP     L               ;
739  5460  CA6A54        JZ      TABB            ;
740  5463  DA6A54        JC      TABB            ;
741  5466  6F            MOV     L,A             ;
742  5467  C3CC50        JMP     INVRC           ;
743  546A  C608    TABB:  ADI     8               ;
744  546C  C35A54        JMP     TABA            ;
745                     ;
746                     ;
747                     ;
748                     ;     FLIP BAUD RATE TO EITHER 1200 OR 300 BAUD
749                     ;
750  546F  3A07D7  BAUD:  LDA     BRATE           ; PICK UP CURRENT SIO CTL WORD
751  5472  FE11          CPI     11H             ; IS IT 1200 BAUD 8-DATA BITS, 2-STOP BIT
752  5474  CA7F54        JZ      BAUD1           ; YES, CHANGE TO 12
753  5477  3E11          MVI     A,11H           ;
754  5479  11DE55        LXI     D,M1200         ; 1200-BAUD MSG
755  547C  C3A354        JMP     BAUD2           ;
756  547F  3C      BAUD1: INR     A               ; MAKE 300-BAUD, ETC
757  5480  11F054        LXI     D,M300          ; 300-BAUD MSG
758  5483  3207D7  BAUD2: STA     BRATE           ;
759  5486  CD8F54        CALL    TVMSG           ; OUTPUT MSG TO TV
760  5489  C35C50        JMP     RESTAR          ;
761                     ;  GIVE HELP
762                     ;
763  548C  116955  HELP:  LXI     D,HMSG          ; OUTPUT TO TV USER MSG
764  548F  2A00CC  TVMSG: LXI     H,TOP           ; POINT TO TOP OF TV BUFFER
765  5492  1A      TVMGA: LDAX    D               ; PICK UP CHAR TO BE OUTPUT
766  5493  FE24          CPI     '$'             ; ENDING?
767  5495  C8            RZ                      ; FINISHED WHEN $ ENCOUNTERED
768  5496  77            MOV     M,A             ; OUTPUT IT
769  5497  23            INX     H               ;
770  5498  13            INX     D               ;
771  5499  C39254        JMP     TVMGA           ;
772                     ;
773                     ;     STORAGE ALLOCATION
774                     ;
775  549C  0000    MASK:  DW      0000H           ;
776  549E  00900000      DW      9000H+0,1100H   ; TTY BUFFER, ..
776  54A2  0011
777  54A4  11            DB      11H             ; 1200 BAUD
778  54A5  80CF          DW      TOP+380H        ; POINTER TO BEGINNING OF EDIT BUFFER
779  54A7  40CF          DW      TOP+340H        ;TVBUF LOCATION   FOR OUTPUT
780  54A9  00DA          DW      0DA00H          ;
781                     ;
782                     ;
783  54AB  2A2A2055 RMSG:  DB     '** USER SIGN ON INFORMATION **'
783  54AF  53455220
783  54B3  5349474E
783  54B7  204F4E20
783  54BB  494E464F
783  54BF  524D4154
783  54C3  494F4E20
783  54C7  2A2A
784  54C9  0D              DB     CR
785  54CA  43414E4E UMSG:  DB     'CANNED MESSAGE TWO'
785  54CE  4544204D
785  54D2  45535341
785  54D6  47452054
785  54DA  574F
786  54DC  0D              DB     CR
787  54DD  43414E4E SMSG:  DB     'CANNED MESSAGE ONE'
787  54E1  4544204D
787  54E5  45535341
787  54E9  474520CF
787  54ED  4E45
788  54EF  0D              DB     CR
789  54F0  2A2A2A2A M300:  DB     '****** BAUD RATE 300 ********$'
789  54F4  2A2A2042
789  54F8  41554A20
789  54FC  52415445
789  5500  20333030
789  5504  202A2A2A
789  5508  2A2A2A2A
789  550C  2A24
790  550E  2A2A2A2A M1200:  DB     '****** BAUD RATE 1200 ********$'
790  5512  2A2A2042
790  5516  41554A20
790  551A  52415445
790  551E  20313230
790  5522  30202A2A
790  5526  2A2A2A2A
790  552A  2A2A24
791  552D  2A2A2A2A FINMSG: DB     '***** HEX OBJECT IS LOADED *****$'
791  5531  2A204845
791  5535  58204F42
791  5539  4A454354
791  553D  20495320
791  5541  4C4F4144
791  5545  45442A2A
791  5549  2A2A2A24
792  554D  2A2A2A2A CKMSG:  DB     '***** CHECK SUM ERROR *****$'
792  5551  2A20434B
792  5555  5343554D
792  5559  53554D20
792  555D  4552524F
792  5561  52202A2A
792  5565  2A2A2A24
793  5569  2A2A2A20 HMSG:  DB     '*** TERMINAL CONTROL FUNCTIONS CTL-(?) *** '
793  556D  54455243
793  5571  494E414C
793  5575  20434F4E
793  5579  54524F4C
793  557D  204655E
793  5581  4354494F
793  5585  4E532043
793  5589  54C2D2A
793  558D  3F29202A
793  5591  2A2A20
794  5594  28412920          DB     '(A) RETURN TO MONITOR (B) SEND MSG 2 ! (C) RET TO ASSM! '
794  5598  52455455
794  559C  524E2054
794  55A0  4F204D4F
794  55A4  4E49544F
794  55A8  52202842
794  55AC  29205345
794  55B0  4E442043
794  55B4  53472032
794  55B8  20382029
794  55BC  43292028
794  55C0  45542054
794  55C4  4F204163
794  55C8  534D3829
794  55CC  28412945          DB     '(D)ELETE IN TEXT! (E) SEND  MSG 1! (F) CURSOR LEFT! '
795  55D0  4C455445
795  55D4  20494E20
795  55D8  54455854
795  55DC  3B202845
```

```
795  55E0  29205345
795  55E4  4E442020
795  55E8  40534750
795  55EC  31382020
795  55F0  4629204A
795  55F4  5552534F
795  55F8  52204C45
795  55FC  46543020
796  5600  28472069          DB    '(G) RIGHT; (H)OME; (I)NSERT IN TEXT;   (K) SCROLL UP; '
796  5604  52494748
796  5608  543B2020
796  560C  48294F48
796  5610  453B2020
796  5614  49294E53
796  5618  45525420
796  561C  494F2054
796  5620  4558543B
796  5624  20202020
796  5628  48292053
796  562C  43524F4C
796  5630  4C205550
796  5634  3B20
797  5636  284C2920          DB '(L) DOWN; (N) BASIC INPUT; (O) TAB; (P)EPRINT;   (S)EARCH; (U) '
797  563A  444F574E
797  563E  3B20284F
797  5642  29204241
797  5646  53494320
797  564A  494E5055
797  564E  543B2020
797  5652  51292054
797  5656  41423B20
797  565A  28522945
797  565E  5052494E
797  5662  543B2020
797  5666  20285329
797  566A  45415243
797  566E  483B2020
797  5672  552920
798  5675  4845 C50           DB    'HELP (V) LOAD MEMORY; (W)ORD SKIP OVER; '
798  5679  20285629
798  567D  204C F41
798  5681  4420 D45
798  5685  4D4F5259
798  5689  3B202857
798  568D  294F5249
798  5691  20534B49
798  5695  50204F56
798  5699  45523B20
799  569D  28582920          DB    '(X)  SEND BUF;  (Y) ERASE TO EOL; (Z) STORE IN BUF;'
799  56A1  20534554
799  56A5  44204255
799  56A9  46382020
799  56AD  28592920
799  56B1  45524153
799  56B5  4520544F
799  56B9  20454F4C
799  56BD  3B20284A
799  56C1  29205359
799  56C5  4F524552
799  56C9  494E2042
799  56CD  554638
800  56D0  20284753          DB    ' (GS) 300/1200 BAUD TOGGLE$'
800  56D4  29203330
800  56D8  302F3132
800  56DC  30302042
800  56E0  41554420
800  56E4  544F4747
800  56E8  4C4524
801  D700                    ORG   0D700H
802  D700  0090      EBUF:   DW    9000H
803  D702  0090      SBUF:   DW    9000H
804  D704  00        COUNT:  DB    0
805  D705  00        MFLIP:  DB    0               ; MODEM OUTPUT FLAG
806  D706  00        LASTC:  DB    0               ; ST CHARACTER OUTPUT
807  D707  11        BRATE:  DB    11H             ; 1200-300 BAUD TOGGLE
808  D708  40CF      POINT:  DW    WORD$           ; CURSOR POINTER
809  D70A  40CF      TVBUF:  DW    TOP+340H      ; LINE 14
810  D70C  000A      MBUF:   DW    0DA00H          ; MODEM OUTPUT BUFFER ADDRESS
811  D70E  0000      NBUF:   DW    0               ; CURRENT CHARACTER POINTER IN MODEM BUFF
812  0040            XBUF:   DS    64              ; TEMPORARY LINE BUFFER
813  0040            TBUF:   DS    64              ; BUFFER FOR SAVING EDIT BUFFER CONTENTS
814                     END
    NO PROGRAM ERRORS
```

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SYMBOL TABLE

* 01

A	0007	B	0000	BASIC	0000	BASIN	53B1
BASIO	5397	BAUD	546F	BAUD1	547F	BAUD2	54A3
BEGIN	5043	BLANK	51F5	BLK	0020	BLKA	51F8
BRATE	D707	BREAK	51FF	BYTE	535C	C	0001
CH0	5249	CH1	525D	CH2	525F	CHDFL	52B3
CHDHL	52BB	CHEND	5262	CHKER	538B	CHKT	516B
CHKT1	5183	CHOME	52B1	CHOUT	5233	CKMSG	554D
COUNT	D704	CR	000D	CRLF	510A	CTAB	5003
D	0002	DELET	50EA	DIGIT	5373	DOWN	52F6
E	0003	EBUF	D700	ENDSC	52F2	ERASE	51FF
FIND	53E0	FINDA	53E9	FINDB	53ED	FINDC	53FD
FINMS	552D	FOUND	5413	GSTAB	514C	H	0004
HELP	54BC	HMSG	5569	HOME	5284	INB	50B4
INBAS	04D8	INVRC	50CC	INVRH	50CB	INVRT	52E7
JOUT	5200	JOUTA	5206	KEYI	0001	KEYIN	53BB
KEYS	0000	L	0005	LASTC	D706	LEFT	5274
LENG	528A	LENGA	528F	LENGB	529F	LENGC	529A
LF	000A	LIM1	5169	LIMCH	515F	LOOP	504C
M	0006	M1200	550E	M300	54F0	MASK	549C
MBUF	D70C	MFLIP	D705 *	MIO	0007	MONIT	B800
MOUT	5209	MOVE	52A3	MOVEL	52AA	MSG1	5192
MSG2	5198	MSTAT	0006	NBUF	D70E	NEW	50EB
NEWL	5065	NIO	53B1	NOCR	5129	NOCTL	50A3
NULL	5143	OUBAS	04CD *	OUT7	5227	OUTC	5116
OUTCR	5124	OUTD	510F	OUTI	50D9 *	OUTMG	519E
OUTX	50DC	POINT	D708	PSW	0006	RDA	0001
READ	531A	READ4	5385	READ5	538E	RED1	5339
RED2	534B	RED3	5358	REPA	50FF	REPET	50EF
RESTA	505C	RIGHT	526E	RMSG	54AB *	SAVCR	50D4
SAVE	50C5	SAVEM	5429	SBUF	D702	SC3	51E7
SCDN	51D2	SCDN2	51D4	SCRL	51B2	SCRLX	51B4
SCUP	51C1	SCUP2	51C3	SENDM	5423	SENSE	00FF
SKIP	5439	SKIPA	543C	SMSG	54DD	SP	0006
ST1	507E *	STACK	DFF0	START	5070	TAB	5455
TABA	545A	TABB	546A	TBUF	D750	TOP	CC00
TOPH	00CC	TOUT	514D	TOUT1	5151	TTYBE	0002
TVBUF	D70A	TVCR	5254	TVMGA	5492	TVMSG	548F
UMSG	54CA	UP	52C7	WBLK	00A0	WOB	5266
WORDS	CF80	XBUF	D710	ZERO	51E3		

```
115 RIGHT 051156Q
116 RMSG  052253Q
117 SAVCR 050324Q
118 SAVE  050305Q
119 SAVEM 052051Q
120 SBUF  153402Q
121 SC3   050747Q
122 SCDN  050722Q
123 SCDN2 050724Q
124 SCRL  050662Q
125 SCRLX 050664Q
126 SCUP  050701Q
127 SCUP2 050703Q
128 SENDM 052043Q
129 SENSE 000377Q
130 SKIP  052071Q
131 SKIPA 052074Q
132 SMSG  052335Q
133 SP    000006Q
134 ST1   050176Q
135 STACK 157760Q
136 START 050160Q
137 TAB   052125Q
138 TABA  052132Q
139 TABB  052152Q
140 TBUF  153520Q
141 TOP   146000Q
142 TOPH  000314Q
143 TOUT  050515Q
144 TOUT1 050521Q
145 TTYBE 000002Q
146 TVBUF 153412Q
147 TVCR  051124Q
148 TVMGA 052222Q
149 TVMSG 052217Q
150 UMSG  052312Q
151 UP    051307Q
152 WBLK  000240Q
153 WOB   051146Q
154 WORDS 147600Q
155 XBUF  153420Q
156 ZERO  050743Q
```

OBJECT CODE LISTING

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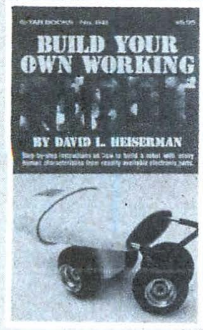

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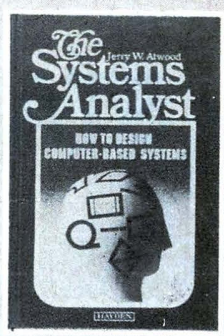

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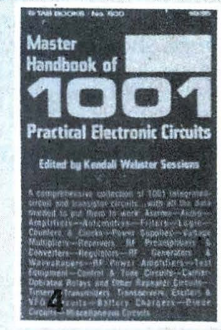

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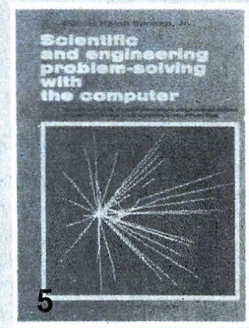

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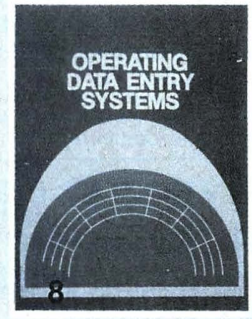

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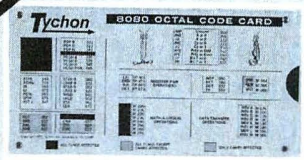

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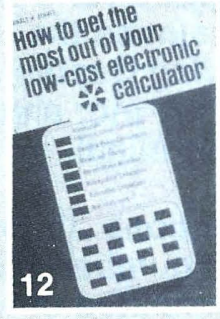

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STAR-SHIP SIMULATION PART II OF III

by Roger C. Garrett*

This is Part II of a three-part presentation. Part I published last month defined simulation, explained its uses and covered systems planning a program for a successful simulation of events anticipated in the real world, or as in this case, in the parareality of science fiction. —*Editor*

MAJOR FUNCTION IDENTIFICATION

1. COMMAND CONTROLLER
2. ENGINEERING
3. COMMUNICATIONS
4. NAVIGATION
5. SCIENCES
6. MEDICAL SYSTEMS
7. HELM

MAJOR FUNCTIONS OBJECTIVES

COMMAND CONTROLLER: The scenario and its associated module, the Command Controller, make it possible for a given sequence of events to be run more than once, allowing the operators to try different methods of handling the given problems. This is different from the average STAR TREK program which has no well-defined sequence of events. It is controlled by operator actions and certain pseudo-random variables. In the simulation, on the other hand, the Command Controller has access to all of the variables throughout all of the modules and thus controls the tactical situations presented to the operators.

In its simplest form (and the form in which it is used in this simulation) a scenario is a set of events and the times at which they are to occur (there is a real-time clock controlled by the helm module). A sample scenario is shown in Figure B.1.

```
TIME     VARIABLE   VALUE       COMMENT
000000 :  KI(1)     : 1         : INITIALIZE ALL MODULES
000000 :  KI(2)     : 1
000000 :  KI(3)     : 1
000000 :  KI(4)     : 1
000000 :  KI(5)     : 1
000000 :  KI(6)     : 1
000010 :  LI(1)     : 1         : TURN ON ALL MODULES
000010 :  LI(2)     : 1
000010 :  LI(3)     : 1
000010 :  LI(4)     : 1
000010 :  LI(5)     : 1
000010 :  LI(6)     : 1
000020 :  WF        : WF + 1    : CREATE A NEW ENEMY
000020 :  QG(WF)    : ZA + 1437 : NEAR THE ENTERPRISE
000020 :  RG(WF)    : AB + 496
000020 :  SG(WF)    : BB        : GOING IN THE SAME DIRECTION
000020 :  TG(WF)    : CB        : AND SPEED AS THE ENTERPRISE
000035 :  BH(WF)    : 1         : MAKE IT AN UNCONDITIONAL ATTACK T
00040 :   LA(3)     : 12        : MAKE THE ENTERPRISE'S PHASER STAT
                                : NUMBER 3 UNRELIABLE
000150 :  OA(2)     : 0         : KNOCK OUT AFT DEFLECTOR SHIELD
000245 :  XF(WF)    : 0         : KNOCK OUT ENEMY'S DEFENSIVE WEAPON
001025 :  BH(WF)    : 3         : MAKE ENEMY'S MISSION TO BE ESTABLISHED
                                : PEACE TREATY
```

Figure B.1 Here

This scenario is pseudo-code to load certain values into the variables in the various modules. For instance, to cause damage to phaser bank 3 the scenario might specify to change the variable named KA(3) from whatever is its current status to a zero, indicating severe damage. The module which monitors that variable would soon recognize the change in status and report it, via an appropriate display, to the operator.

The scenario is read as input to the Command Controller. The function of the Command Controller is to execute the commands in the scenario at the appropriate times. This eliminates the need to write an entirely new simulation each time a different scenario is to be run. The scenario, then, actually defines the mission of the star ship. By writing an appropriate scenario just

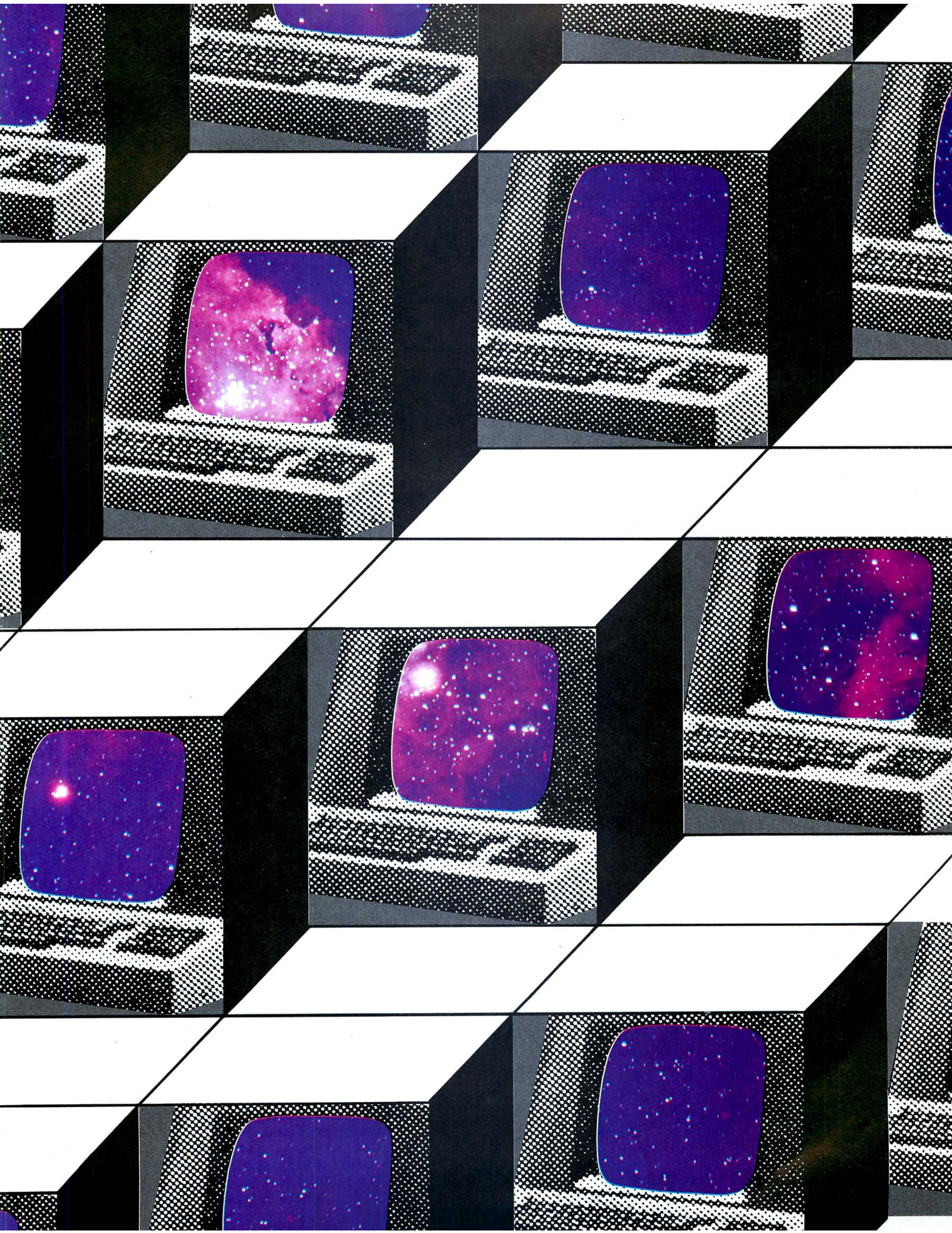
*President, Rhode Island Computer Hobbyist Club (RICH).

SYSTEM OBJECTIVE

A. To develop a software system which will simulate the functions available on a Constitution class Star Ship (the Enterprise).

B. To develop the software for a multi-operator mode in which each operator assumes the role of a particular officer on the bridge including Captain, Navigator, Communications Officer, Engineer, etc. and each one having his own display and input terminal.

C. To simulate the actions (intelligence and tactical maneuvers) of a random number of enemy and Federation space ships within a simulated universe.



about any of the STAR TREK episodes could be simulated. Indeed, the only limit to the kinds of missions that this system could simulate is the user's imagination.

This kind of simulation is used by the armed forces to simulate war games. Several teams of officers operate simulated systems using a given scenario (tactical situation) and then the performances of each of the teams are compared. The purpose of this exercise is to give the officers experience in handling combat situations without any of the dangers.

The scenario described above is a very simple one, allowing only a time-controlled set of events. Now let's look at a more powerful type (not used in this simulation).

This scenario is a type of program being executed interpretively by the Command Controller. However, the instruction set for the scenario is very limited (for our purposes, that is: it could just as easily be expanded). I have allowed only one type of instruction, but it is a powerful statement and sufficient to give the command control operator complete control of the sequence of events. The statement is CONDITIONAL ASSIGNMENT and takes the following form:

Condition : variable name : value : comment

The *condition* is a logical expression; *variable name* is the name of some variable in the common data area; *value* is the value to assign to the variable, and *comment* is, quite naturally, a comment to describe the function of the statement. For example,

MI = 0032 : NA(1) : 0 : WHEN THE TIME REACHES 0032 SET THE STATUS OF DEFLECTOR SHIELD NUMBER 1 TO ZERO

"NA(1)" is the name of the variable containing the current time, the equals sign is a logical operator. "NA(1)" is the name of the variable containing the status value of deflector shield number 1, 0 is the value to be assigned to "NA(1)", and the comment describes what the statement does. At a minimum the numerical operators of addition, subtraction, multiplication, and division, the relational operators greater than, less than, and equal to, and the logical operators AND, OR, and NOT should be recognized in the *conditional* portion of the statement. At least the numerical operators should be recognized in the *value* section. See Figure B.2.

The conditional assignment, then, is a form of IF statement, or more accurately a WHEN statement. When the *condition* is found to be true then the variable is assigned the given value. This means that each statement in the scenario must be checked each time the Command Controller module is executed. The effect is that the scenario is a program which is repeatedly run during the execution of the simulation.

CONDITION	OPERATION	COMMENT
MI = 00134	FB = 0	AT TIME = 134 DISABLE THE ENTERPRISE NAVIGATION
MI = 01037	FA(1) = 40	AT TIME = 1037 MAKE THE CAPTAIN SICK
LB>98	FA(1) = 100	WHEN INTENSIVE CARE UNIT FUNCTIONAL STATUS GOES 98% CURE THE CAPTAIN
(CB>7).OR.(EB<20)	BB = BB-1	IF ENTERPRISE SPEED GOES WARP 7 OR OPSTAT OF NAVIGATION COMPUTER GOES LESS THAN 20 REVERSE DIRECTION
((ZA>43)&(ZA(<45))& ((AB>92)&(AB<95))	ZA = 9347, AB = 448	WHEN ENTERPRISE ENTERS THIS ZONE CAUSE A TIME WARP A DIFFERENT TIME ZONE
MI = 001347	DH = 0	AT TIME = 1347 DELETE ALL FEDERATION SHIPS
(ZA = C(A))&(AB = D(A))	H(A) = HA(A) + 39	IF ENTERPRISE GETS CLOSE TO PLANET A THEN INCREASE PLANET A'S RADIATION
CD(1)>30	BH(3) = 2, BH(4) = 2	IF TRANSPORTER FUNC STATUS GOES BELOW 30 THEN SET MISSION OF TWO ENEMY SHIPS TO UNCONDITIONAL ATTACK

Figure B.2 Fancy Scenario

This gives the programmer greater control over the operation of the simulator. Most simple statements will specify when an event is to occur. With the use of the more involved relational and logical operations, the programmer can make the sequence of events conditional and quite involved (implying realistic). It is through the use of this type of scenario that actual episodes of the STAR TREK television show could be simulated.

The Command Controller module allows the following operator commands:

INITIALIZE ALL MODULES
INITIALIZE A PARTICULAR MODULE
BEGIN EXECUTION OF ALL MODULES
BEGIN EXECUTION OF A PARTICULAR MODULE
HALT EXECUTION OF ALL MODULES
HALT EXECUTION OF A PARTICULAR MODULE
DISPLAY VALUE OF ALL COMMON DATA VARIABLES FOR A PARTICULAR MODULE
DISPLAY VALUE OF A PARTICULAR COMMON DATA VARIABLE
ASSIGN VALUE TO A PARTICULAR COMMON DATA VARIABLE
RANDOMIZE VALUE OF A PARTICULAR COMMON DATA VARIABLE
RANDOMIZE VALUES OF ALL COMMON DATA VARIABLES OF A PARTICULAR MODULE
LOAD A SCENARIO
RUN THE LOADED SCENARIO
HALT THE SCENARIO

COMMUNICATIONS: The Communications Module is responsible for maintaining the status of intra-ship as well as inter-space communications and the location of personnel. It receives and displays messages coming from the various stations throughout the ship and from other craft and planets. It also enables the Enterprise to send and receive messages (e.g. distress calls) and initiate the transfer of personnel from one section of the Enterprise to another.

This last function is of particular importance since it is through the Communications Officer that maintenance personnel are sent to repair damaged hardware, medical personnel are dispatched to the intensive care unit, search parties are sent to the shuttlecraft, etc.

The valid communications commands are:

DISPLAY MESSAGE FROM SENDER
SEND DISTRESS MESSAGE
REQUEST PERSONNEL MOVEMENT
REQUEST AID FROM A FEDERATION SHIP
SEND PEACE TREATY OFFER
ACCEPT PEACE TREATY OFFER
REJECT PEACE TREATY OFFER

NAVIGATION: The Navigation Module maintains and reports the status of the navigation computer. It allows courses to be set and laid in for point-to-point travel. It calculates courses for obtaining and breaking orbits around planets or other objects utilizing the navigation "computer." It provides a display of the projected universe and the local sector including the Enterprise's current position and course as well as the course of enemy and friendly craft. It maintains the ship's chronometer (real-time clock). It simulates the intelligence and tactical maneuvers of enemy and Federation space craft and the Enterprise shuttlecraft. It simulates the natural physical interactions of stellar objects such as class of sun, mass, gravity, atmospheric composition, orbits of planets and its moons (if any) etc.

The intelligence of targets is not in that they can learn, but rather that they react in an intelligent and reasonable manner. Unlike most STAR TREK games where the enemy craft sit in one spot and fire only when the Enterprise makes a move, the enemy craft in the simulation roam throughout the universe, some looking to attack Federation space ships, others trying to conquer civilizations, others delivering goods or weapons,

and others seeking peace treaties.

There are Federation craft as well. They, too, are intelligent. Indeed, there can be battles waged between enemy and Federation craft at one end of the universe as the Enterprises traverses the other end completely unaware of the encounter. A war may be won without the Enterprise even knowing about it.

The valid navigation commands are:

SET COURSE TO COORDINATES
SET COURSE TO STAR/PLANET
SET COURSE TO ENEMY/FEDERATION SPACE CRAFT
SET VELOCITY
SET DIRECTION
ESTABLISH ORBIT

SCIENCES: The Sciences Module monitors the functional status of the life support systems, including food, air, and water supply. It also monitors the life forms, gravity, radiation, functional status, and fire power of planets and other space craft.

The Science Officer can request sensor data of stellar objects or general sensor scan of areas of space.

The valid Science Officer commands are:

SCAN STELLAR OBJECT
SCAN AREA
SCAN ENEMY/FEDERATION SPACE CRAFT
SCAN RANDOMLY

ENGINEERING: The Engineering Module maintains the status of the shuttlecraft, transporters, energy supply, space/warp and impulse engines, main craft structural damage, turbo-elevators, etc. It allows the Engineer to specify the distribution of energy to the various sections of the ship.

The valid Engineering Officer commands are:

SET ENERGY SUPPLY TO DEVICE
SET ENERGY SUPPLY TO SHIP SECTION
REPORT STATUS OF DEVICE (SHUTTLECRAFT, TRANSPORTERS, SPACE/WARP ENGINES, ETC.)

MEDICAL MODULE: The Medical Module maintains the health status of all of the crew members. It keeps track of the number and status of its patients, the patient capacity of the medical stations, the medical personnel, the functional status of its intensive care units and other hardware.

While there is no operator input to the Medical Module, and hence no need for a Medical Officer, there is a display of the medical data. The only operator input to this module is indirectly through the Communications Officer. When crew members (not the actual operators) are found to be sick (diminishing health status) the

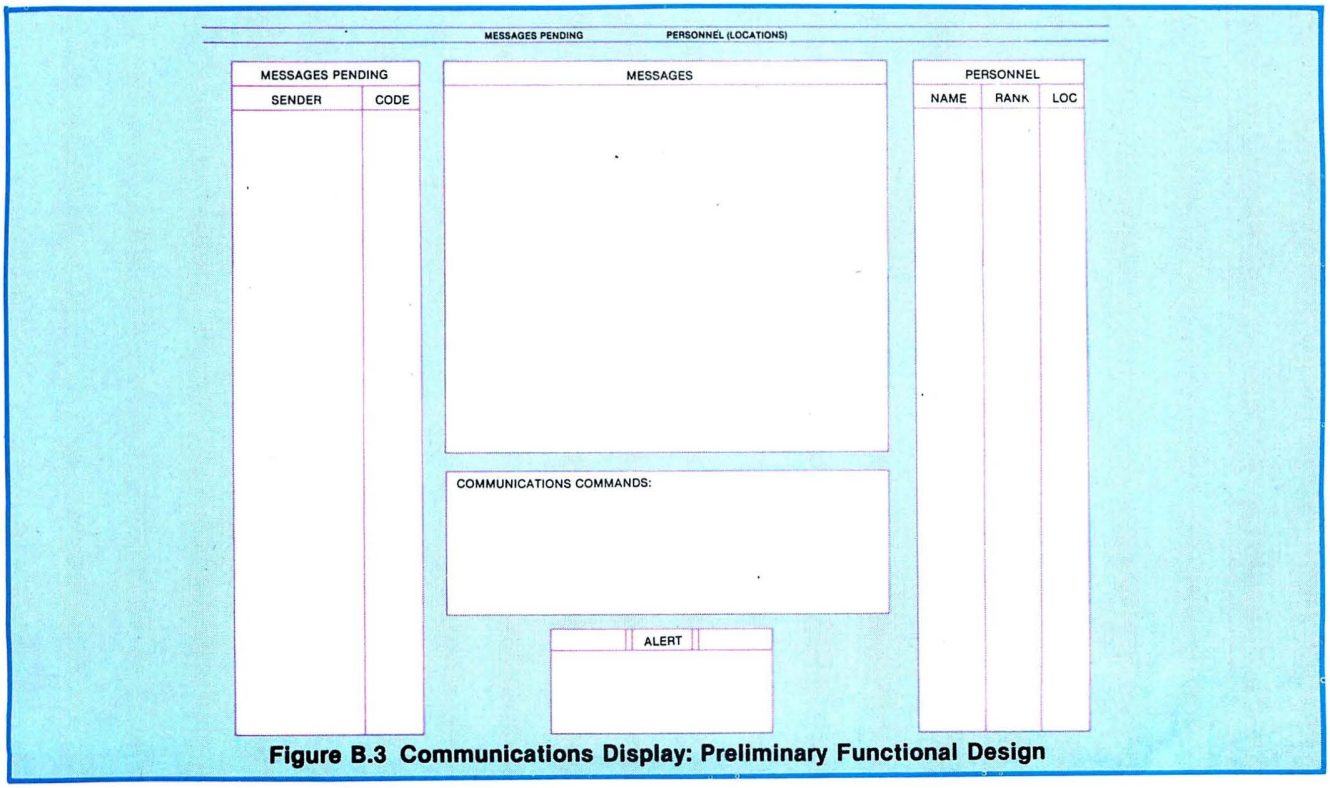


Figure B.3 Communications Display: Preliminary Functional Design

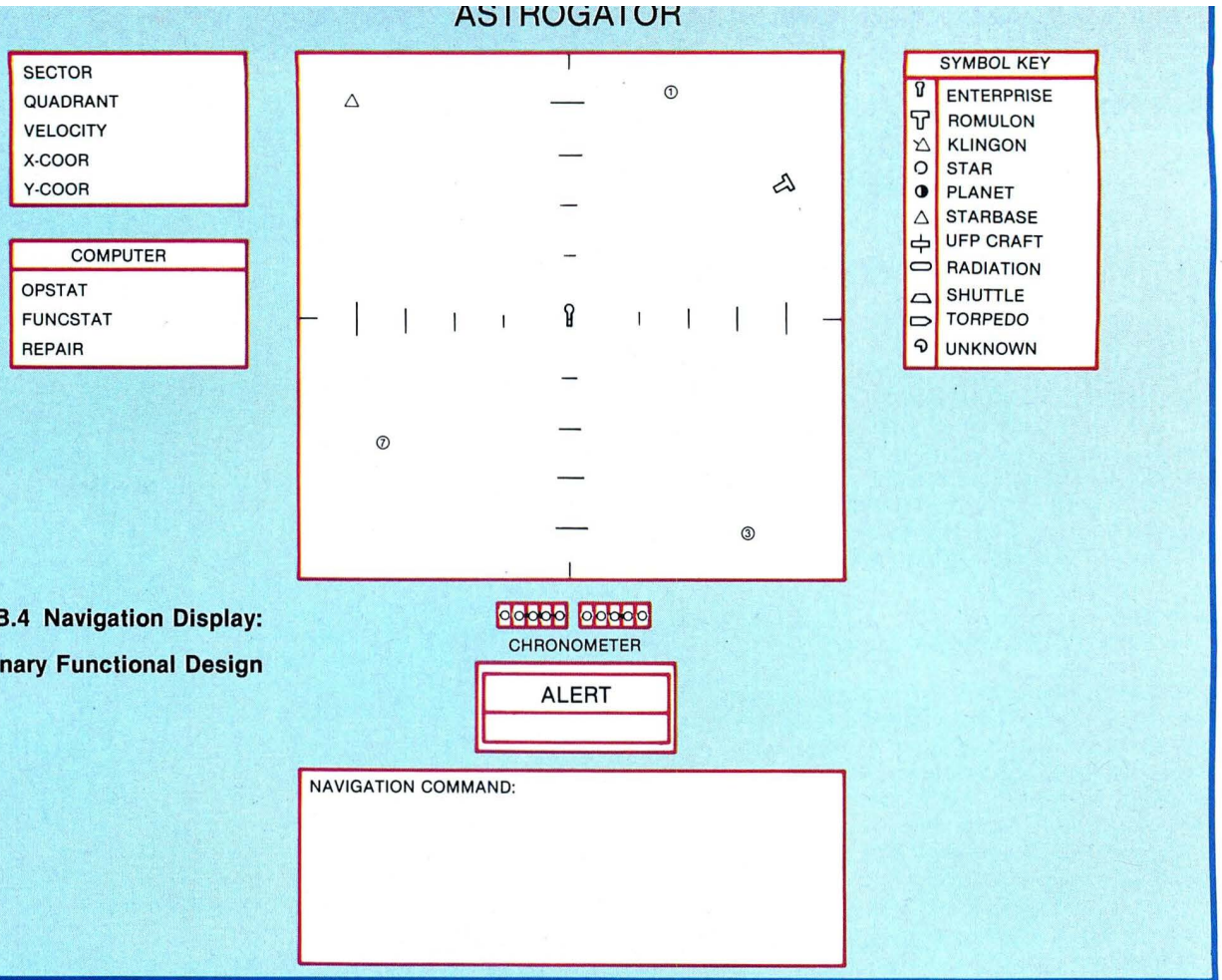
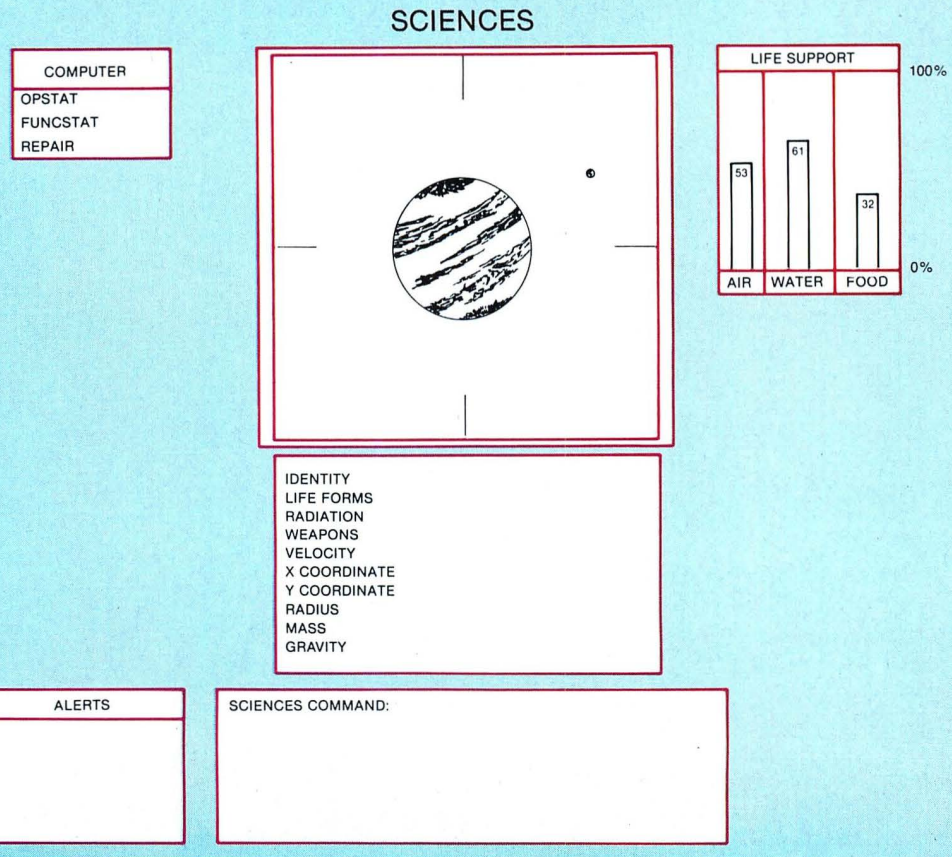


Figure B.4 Navigation Display: Preliminary Functional Design

Figure B.5 Sciences Display: Preliminary Functional Design



Communications Officer sends them a message to proceed to the intensive care unit. While they are there their health condition will improve (or worsen) depending upon the functional and operational status of the intensive care unit, the medical computer, and medical research laboratory, the number of patients, the number of medical personnel, and the available energy.

HELM: The Helm Module maintains the status of the offensive and defensive weapons. It allows the firing of phasers and photon torpedoes and the control of the deflector shields.

The valid Helm commands are:

FIRE PHASERS
FIRE PHOTON TORPEDO
SET DEFLECTOR SHIELD

MAJOR FUNCTIONS INTERFACE

Each module in this simulation is a subroutine with access to a common data area. It is assumed that all modules reside in main memory and are executed sequentially under control of the Command Controller. A portion of main memory is reserved as a common data area and all modules have read/write access to it. What follows is a list of the variables in this common data area.

Text enclosed in angle brackets < > defines the major classification of the variables that follow. Text followed by a colon (:) indicates a sub-classification. Each actual variable is preceded by a one or two characters-variable names. A more descriptive multi-character name would be preferred but this system was designed with BASIC in mind as the implementing language. Data identifications followed by a set of parentheses ( ) indicate an array variable. A number within the parentheses specifies the dimension of the array. Where no number appears within the parentheses the array size is unspecified (or random). Commas within parentheses indicate additional dimensions (e.g. (,) means a two-dimensional array with each dimension unspecified). Text enclosed in square brackets [ ] denotes information about the variable such as the numerical range or units. REL means "relative to" and OPSTAT stands for "operational status." So REL: OPSTAT implies that the value of the associated value is related to the operational status of the associated device and the actual relationship is defined in the logic flow definitions.

For example, under ENTERPRISE SHUTTLECRAFT DATA the line LOCATION(6,2) indicates an array, each element of which specifies the X and Y coordinates of one of the six shuttlecraft. The SHUTTLECRAFT PROPULSION TUBES : RELIABILITY FACTOR (6,2) is a two-dimensioned array. Each of the six shuttlecraft has two propulsion tubes. So DC(1,1) holds the reliability factor of the tube number one on shuttlecraft number one, DC (1,2) holds the reliability factor of tube two craft one, etc.

COMMON DATA AREA

	<STELLAR DATA>	
	STELLAR OBJECTS :	
A	NUMBER	
B	CLASSIFICATION(A)	[1 : STAR [2 : BLACK HOLE [3 : PARTICLE CLOUD [4 : TIME/WARP [5 : PLANET [6 : MOON
	LOCATION :	
C	X COORDINATE(A)	
D	Y COORDINATE(A)	
	VELOCITY VECTOR :	
E	DIRECTION(A)	[0 - 360 DEGREES]
F	SPEED(A)	
G	RADIUS(A)	
H	RADIATION LEVEL(A)	
I	MASS(A)	
	LIFE FORMS :	
J	NUMBER(A)	
K	CLASSIFICATION(A)	[1 : HUMANOID [2 : VEGETATION [3 : AQUATIC [ETC.
L	INTELLIGENCE QUOTIENT(A)	[0 - 300]
	OFFENSIVE WEAPONS :	

Figure B.6a Engineering Displays: Preliminary Functional Designs

PRIMARY DAMAGE

SECTION	STATUS		ETR
	DAMAGE	REPAIR	

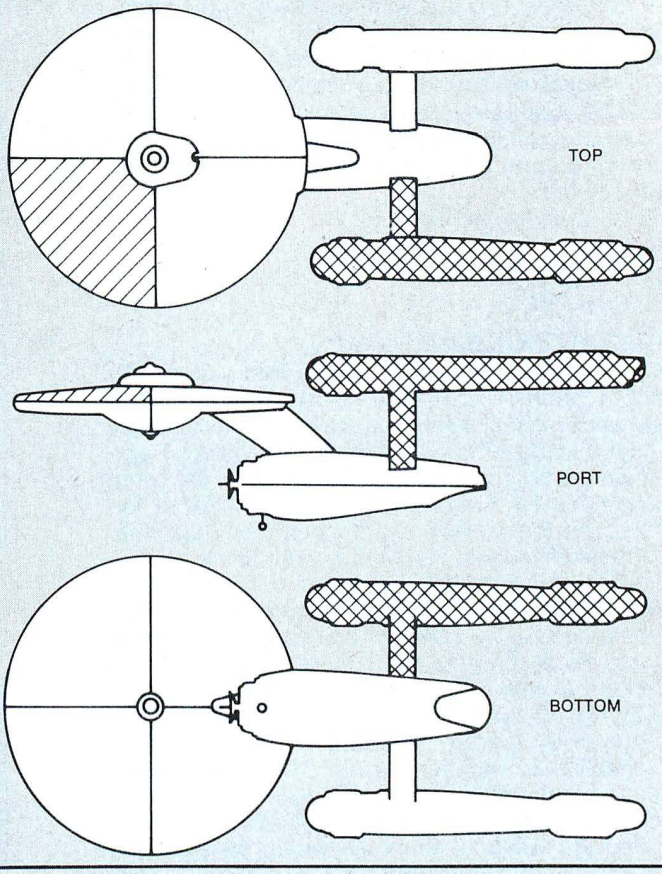
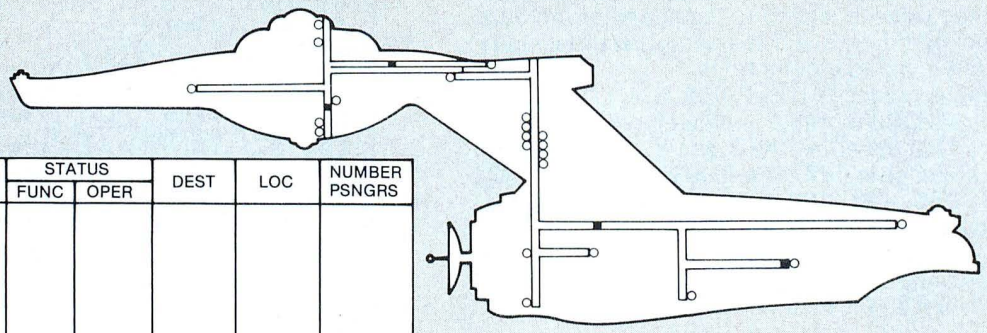


Figure B.6b

TURBO-ELEVATOR



T/E CAR	STATUS		DEST	LOC	NUMBER PSNGRS
	FUNC	OPER			
T/E TUBE					

T/E COMPUTER
OPSTAT
FUNCSTAT
REPAIR

Figure B.7 Medical Display: Preliminary Functional Design

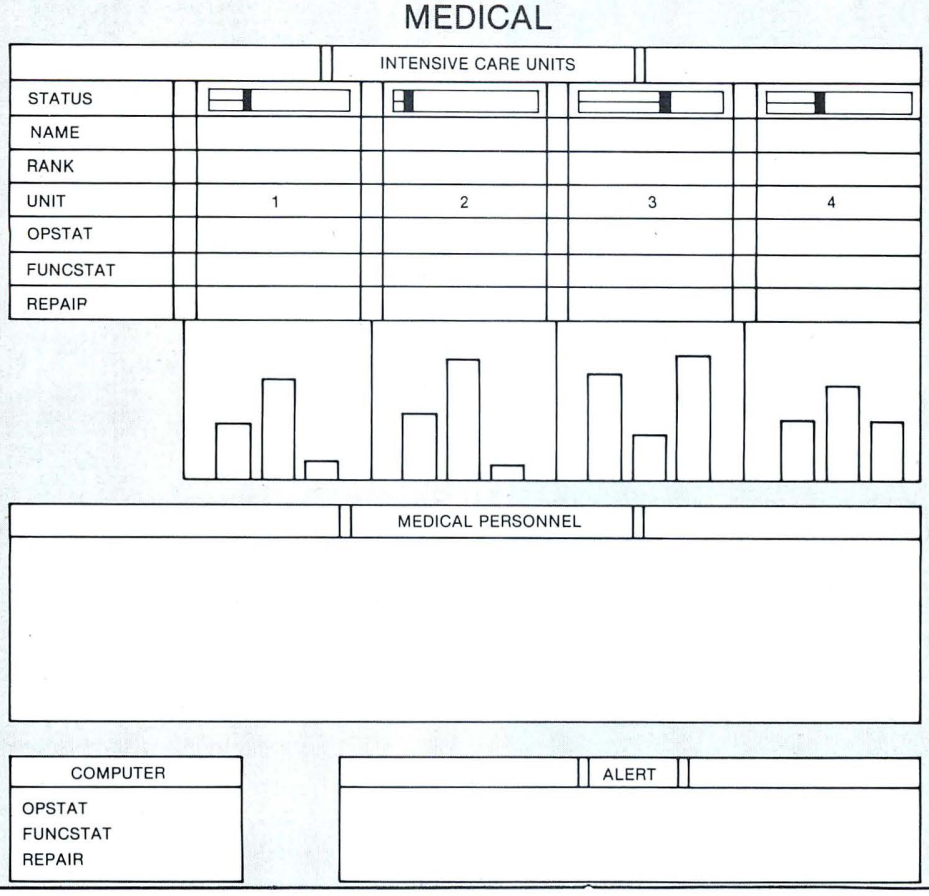
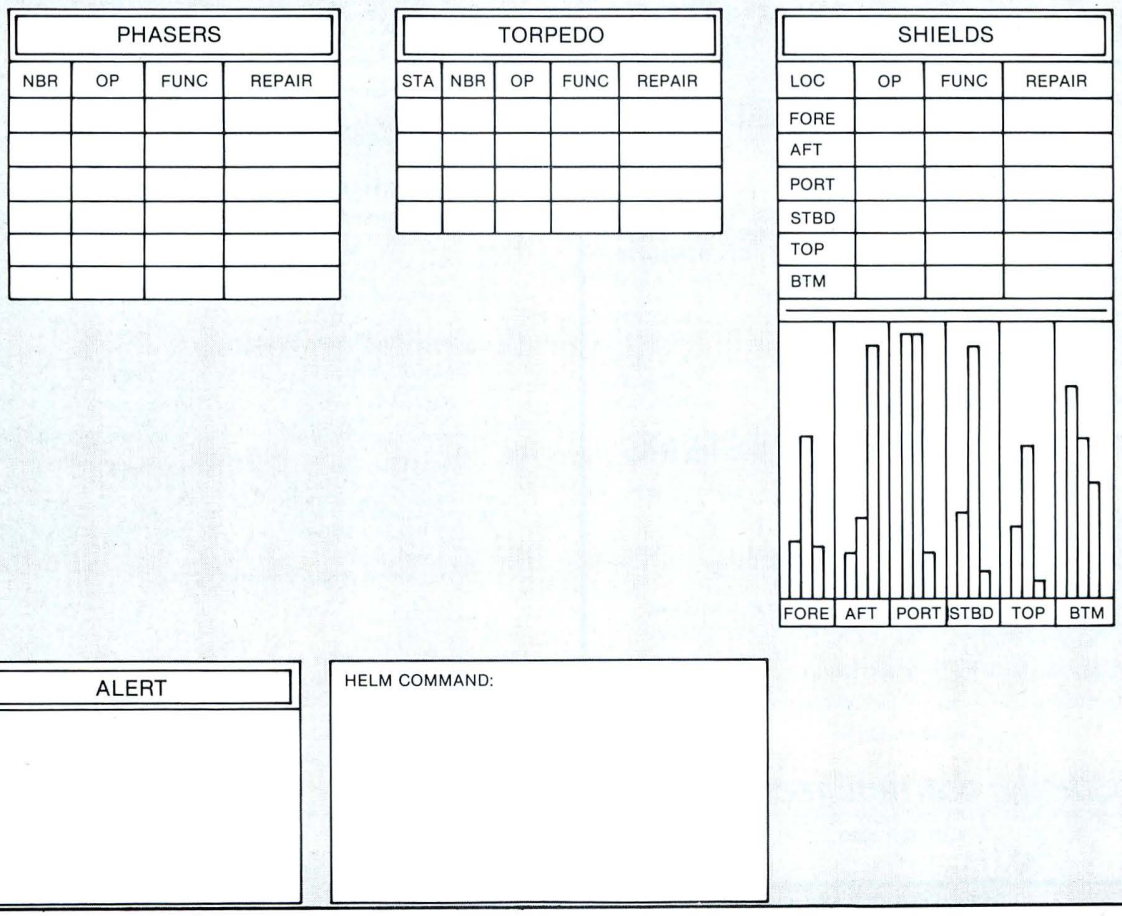


Figure B.8 Helm Display: Preliminary Functional Design



```
M    NUMBER(A)
N    TYPE(A,M)                      [ 1 = SHIELD SCREEN ]
O    FUNCTIONAL STATUS(A,M)         [ 0 - 100% ]
P    OPERATIONAL STATUS(A,M)        [ REL: TYPE ]
Q    RELIABILITY FACTOR(A,M)        [ 0 - 100% ]
R    ENERGY REQUIREMENT(A,M)        [UNITS PER UNIT-TIME, REL: OP STAT]
     DEFENSIVE WEAPONS :
S    NUMBER(A)
T    TYPE(A,S)                      [ 1 = PHASER
                                    [ 2 = PHOTON TORPEDO ]
U    FUNCTIONAL STATUS(A,S)         [ 0 - 100% ]
V    OPERATIONAL STATUS(A,S)        [ REL: TYPE ]
W    RELIABILITY FACTOR(A,S)        [ 0 - 100% ]
X    ENERGY REQUIREMENT(A,S)        [UNITS PER UNIT-TIME, REL: OP STAT]


     <·····DATA ASSOCIATED WITH THE ENTERPRISE·····>

     <ENTERPRISE PERSONNEL DATA>
     PERSONNEL :
Y    NUMBER
Z    NAME(Y)
AA   RANK(Y)                        [ 1 : CAPTAIN
                                    [ 2 : FIRST OFFICER
                                    [ ETC.
BA   INTELLIGENCE(Y)                [ 0 - 300 ]
CA   LOCATION(Y)                    [ <0 : NONEXISTENT (DESTROYED)
                                    [ 0 : BRIDGE
                                    [ 1 : SCIENCES LABORATORY
                                    [ 2 : ENGINEERING
                                    [ 3 : BRIG (PRISON)
                                    [ 4 : SECURITY
                                    [ 5 : NAVIGATION COMPUTER
                                    [ 6 : MEDICAL RESEARCH LABORATORY
                                    [ 7 : MEDICAL COMPUTER
                                    [ 8 : TURBO-ELEVATOR COMPUTER
                                    [ 9 : TRACTOR BEAM
                                    [ 10 : FOOD PROCESSING PLANT
                                    [ 11 : OXYGEN STORAGE
                                    [ 12 : WATER STORAGE
                                    [ 13 : ENERGY SUPPLY
                                    [ 14 : INTENSIVE CARE UNIT
                                    [ 15 : SENSOR STATION
                                    [ 20 - 2N : TRANSPORTER STATION N
                                    [ 30 - 3N : TURBO-ELEVATOR STATION N
                                    [ 40 - 4N : TURBO-ELEVATOR N
                                    [ 50 - 5N : SHUTTLECRAFT N
                                    [ 60 - 63 : PHOTON TORPEDO TUBE STAT
                                    [ 70 - 75 : PHASER STATION
                                    [ 80 - 85 : DEFLECTOR SHIELD STATION
                                    [ 90 - 99 : TURBO-ELEVATOR TUBE
                                    [ 100 - 111 : DETENTION CELLS
                                    [ 1000 - 1NNN : STELLAR OBJECT
DA   DESTINATION(Y)                 [ SAME CODES AS LOCATION ]
EA   FUNCTIONAL STATUS(Y)           [ 0 - 100%, 0 = DEAD ]
FA   HEALTH STATUS(Y)               [ 0 - 10 , 0 = DEAD ]

     <ENTERPRISE WEAPONS DATA>

     <OFFENSIVE WEAPONS>

     PHOTON TORPEDO TUBES :         [ 4 STATIONS ]
GA     NUMBER OF PHOTON TORPEDOS(4) [ 0 - 20 ]
HA     FUNCTIONAL STATUS(4)         [ 0 - 100% ]
IA     RELIABILITY FACTOR(4)        [ 0 - 100% ]
JA     ENERGY REQUIREMENT           [ UNITS PER FIRING ]

     PHASER STATIONS :              [ 6 STATIONS ]
KA     FUNCTIONAL STATUS(6)         [ 0 - 100% ]
LA     RELIABILITY FACTOR(6)        [ 0 - 100% ]
MA     ENERGY REQUIREMENT           [ UNITS PER FIRING ]

     <ENTERPRISE DEFENSIVE WEAPONS>

     DEFLECTOR SHIELDS :            [ FORE, AFT, PORT, STARBOARD, TOP,
                                    [ BOTTOM
NA     FUNCTIONAL STATUS(6)         [ 0 - 100% ]
OA     OPERATIONAL STATUS(6)        [ 0 - 100% ]
PA     RELIABILITY FACTOR(6)        [ 0 - 100% ]
QA     ENERGY REQUIREMENT           [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     <ENTERPRISE PROPULSION DATA>

     SPACE/WARP ENGINES :           [ 2 ENGINES ]
RA     FUNCTIONAL STATUS(2)         [ 0 - 100% ]
SA     OPERATIONAL STATUS           [ 0 - 20 WARP ]
TA     RELIABILITY FACTOR(2)        [ 0 - 100% ]
UA     ENERGY REQUIREMENT           [ UNITS PER UNIT-TIME ; REL: OPSTAT
     IMPULSE ENGINES :              [ 4 ENGINES ]
VA     FUNCTIONAL STATUS(4)         [ 0 - 100% ]
WA     OPERATIONAL STATUS(4)        [ 0 - 100% ]
XA     RELIABILITY FACTOR(4)        [ 0 - 100% ]
YA     ENERGY REQUIREMENT           [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     <ENTERPRISE NAVIGATION DATA>

     LOCATION :
ZA     X COORDINATE
AB     Y COORDINATE
     VELOCITY VECTOR :
BB     DIRECTION                    [ 0 - 360 DEGREES ]
CB     SPEED                        [ 0 - WARP 20 ]
     NAVIGATION COMPUTER :
DB     FUNCTIONAL STATUS            [ 0 - 100% ]
EB     OPERATIONAL STATUS           [ 0 - 100% ]
FB     RELIABILITY FACTOR           [ 0 - 100% ]
GB     ENERGY REQUIREMENT           [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     <ENTERPRISE MEDICAL SECTION DATA>

     RESEARCH LAB :
HB     FUNCTIONAL STATUS            [ 0 - 100% ]
IB     OPERATIONAL STATUS           [ 0 - 100% ]
JB     RELIABILITY FACTOR           [ 0 - 100% ]
```

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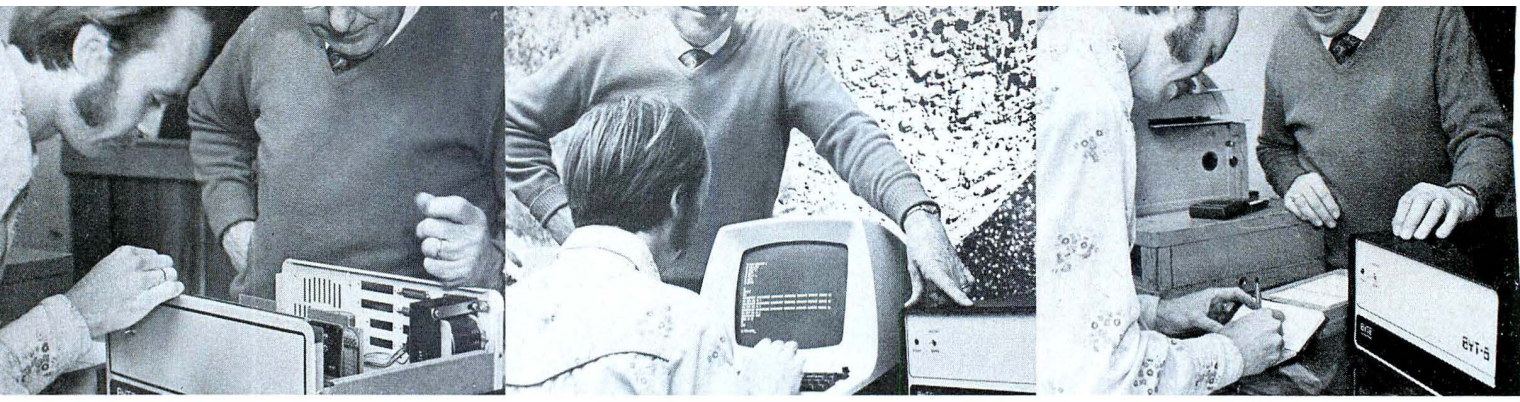

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```
KB    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]
      INTENSIVE CARE UNIT :
LB    FUNCTIONAL STATUS                 [ 0 - 100% ]
MB    OPERATIONAL STATUS                [ 0 - 100% ]
NB    RELIABILITY FACTOR                [ 0 - 100% ]
OB    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]
PB    PATIENT CAPACITY                  [ 0 - 30 : REL: OPSTAT ]
      MEDICAL COMPUTER :
QB    FUNCTIONAL STATUS                 [ 0 - 100% ]
RB    OPERATIONAL STATUS                [ 0 - 100% ]
SB    RELIABILITY FACTOR                [ 0 - 100% ]
TB    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]
      <ENTERPRISE SHUTTLECRAFT DATA  >

UB    OPERATIONAL STATUS(6)
      LOCATION :
VB    X COORDINATE(6)
WB    Y COORDINATE(6)
      VELOCITY VECTOR :
XB    DIRECTION(6)                      [ 0 - 360 DEGREES ]
YB    SPEED(6)                          [ KILOMETERS PER SECOND ]
ZB    MISSION(6)                        [ 0 : IN SHUTTLE BAY
                                        [ 1 : SEEK SENSOR DATA
                                        [ 2 : DELIVERY CARGO
                                        [ 3 : TRANSPORT PERSONNEL
AC    CARGO(6)

      SHUTTLECRAFT PROPULSION TUBES :   [ 2 TUBES FOR EACH OF
                                        [ 6 SHUTTLECRAFT
BC    FUNCTIONAL STATUS(6,2)            [ 0 - 100% ]
CC    OPERATIONAL STATUS(6,2)           [ 0 - 100% ]
DC    RELIABILITY FACTOR(6,2)           [ 0 - 100% ]
EC    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]
      SHUTTLECRAFT SENSOR ARRAY :
FB    FUNCTIONAL STATUS(6)              [ 0 - 100% ]
GB    OPERATIONAL STATUS(6)             [ 0 - 100% ]
HB    RELIABILITY FACTOR(6)             [ 0 - 100% ]
IB    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]
      SHUTTLECRAFT DEFENSIVE WEAPONS :
      PHASERS :
JC    FUNCTIONAL STATUS(6,2)            [ 0 - 100% ]
KC    OPERATIONAL STATUS(6,2)           [ 0 - 100% ]
LC    RELIABILITY FACTOR(6,2)           [ 0 - 100% ]
MC    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]
      SHUTTLECRAFT OFFENSIVE WEAPONS :
      DEFLECTOR SHIELDS :               [ FORE, AFT, PORT, STARBOARD,
                                        [ TOP, BOTTOM
NC    FUNCTIONAL STATUS(6,2)            [ 0 - 100% ]
OC    OPERATIONAL STATUS(6,2)           [ 0 - 100% ]
PC    RELIABILITY FACTOR(6,2)           [ 0 - 100% ]
QC    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]

      <ENTERPRISE INTRA-SHIP TRANSPORTATION DATA>

      TURBO-ELEVATOR :
      STATIONS :
RC    FUNCTIONAL STATUS()               [ 0 - 100% ]
SC    OPERATIONAL STATUS()              [ 0 - 100% ]
TC    RELIABILITY FACTOR()              [ 0 - 100% ]
UC    DESTINATION()

      TURBO-ELEVATOR INTERCONNECT TUBES :
VC    FUNCTIONAL STATUS()               [ 0 - 100% ]
WC    OPERATIONAL STATUS()              [ 0 - 100% ]
XC    RELIABILITY FACTOR()              [ 0 - 100% ]

      TURBO-ELEVATOR COMPUTER :
YC    FUNCTIONAL STATUS                 [ 0 - 100% ]
ZC    OPERATIONAL STATUS                [ 0 - 100% ]
AD    RELIABILITY FACTOR                [ 0 - 100% ]
BD    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME ]

      <ENTERPRISE TRANSPORTER DATA>

      STATIONS :
CD    FUNCTIONAL STATUS()               [ 0 - 100% ]
DD    OPERATIONAL STATUS()              [ 0 - 100% ]
ED    RELIABILITY FACTOR()              [ 0 - 100% ]
FD    ENERGY REQUIREMENT                [ UNITS PER TRANSPORT; REL DISTANCE

      <ENTERPRISE TRACTOR BEAM DATA>

      TRACTOR BEAM :
GD    FUNCTIONAL STATUS                 [ 0 - 100% ]
HD    OPERATIONAL STATUS                [ 0 - 100% ]
ID    RELIABILITY FACTOR                [ 0 - 100% ]
JD    IDENTITY OF OBJECT BEING PULLED   [ SEE PERSONNEL DESTINATION
                                        [ CODES ]
KD    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OBJECT
                                        [ MASS ]
      <ENTERPRISE LIFE SUPPORT SYSTEMS DATA>

                                        FOOD SUPPLY :
LD    QUANTITY                          [ 0 100000 KILOGRAMS ]
MD    NUTRITION LEVEL                   [ 0 - 100% ]
ND    POLLUTION LEVEL                   [ 0 - 100% ]
      OXYGEN:
OD    QUANTITY                          [ 0 - 1 BILLION CUBIC FEET ]
PD    POLLUTION LEVEL                   [ 0 - 100% ]

      OXYGEN DISTRIBUTION SYSTEM :
QD    FUNCTIONAL STATUS                 [ 0 - 100% ]
RD    OPERATIONAL STATUS                [ 0 - 100% ]
SD    RELIABILITY FACTOR                [ 0 - 100% ]
TD    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]

      OXYGEN RECYCLE SYSTEM :
UD    FUNCTIONAL STATUS                 [ 0 - 100% ]
VD    OPERATIONAL STATUS                [ 0 - 100% ]
WD    RELIABILITY FACTOR                [ 0 - 100% ]
XD    ENERGY REQUIREMENT                [ UNITS PER UNIT-TIME; REL: OPSTAT ]

      WATER :
YD    QUANTITY                          [ 0 1 MILLION KILOLITERS ]
```

```
ZD   POLLUTI  N LEVEL                    [ 0 - 100% ]
     WATER D STRIBUTION SYSTEM :
AE    FUNCTIONAL STATUS                  [ 0 - 100% ]
BE    OPERATIONAL STATUS                 [ 0 - 100% ]
CE    RELIABILITY FACTOR                 [ 0 - 100% ]
DE    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     WATER RECYCLE SYSTEM :
EE    FUNCTIONAL STATUS                  [ 0 - 100% ]
FE    OPERATIONAL STATUS                 [ 0 - 100% ]
GE    RELIABILITY FACTOR                 [ 0 - 100% ]
HE    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     <ENTERPRISE COMMUNICATION DATA>

     <INTRA-SHIP COMMUNICATIONS DATA>

     MESSAGES :                         [ ONE PER COMMUNICATIONS STATION ]
IE    MESSAGE READY FLAG()
JE    MESSAGE()                          [ ALPHA-NUMERICS ]

     COMMUNICATION STATIONS :
KE    FUNCTIONAL STATUS()                [ 0 - 100% ]
LE    OPERATIONAL STATUS()               [ 0 - 100% ]
ME    RELIABILITY FACTOR()               [ 0 - 100% ]
      ENERGY REQUIREMENT :
NE     STANDBY                           [ UNITS PER UNIT-TIME ]
OE     OPERATIONAL                       [ UNITS PER MESSAGE SENT OR RECEIVED

     <INTER-STELLAR COMMUNICATIONS DATA>

     ENTERPRISE COMMUNICATIONS COMPUTER :
PE    FUNCTIONAL STATUS                  [ 0 - 100% ]
QE    OPERATIONAL STATUS                 [ 0 - 100% ]
RE    RELIABILITY FACTOR                 [ 0 - 100% ]
SE    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     <ENTERPRISE SECURITY DATA>

     DETENTION CELLS :                  [ 12 CELLS ]
TE    FUNCTIONAL STATUS(12)              [ 0 - 100% ]
UE    OPERATIONAL STATUS(12)             [ 0 - 100% ]
VE    RELIABILITY FACTOR(12)             [ 0 - 100% ]
WE    ENERGY REQUIREMENTS                [ UNITS PER PRISONER ]

     <ENTERPRISE ENERGY SUPPLY DATA>

     ENERGY :
XE    QUANTITY                           [ 0 - 10!10 ERGS ]
      DISTRIBUTION SYSTEM :
YE    FUNCTIONAL STATUS                  [ 0 - 100% ]
ZE    OPERATIONAL STATUS                 [ 0 - 100% ]
AF    RELIABILITY FACTOR                 [ 0 - 100% ]
BF    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]
      ENERGY SUPPLY INTERCONNECT SYSTEM :
      CONNECTION STATIONS :              [ SPECIFIED ENERGY CONSUMING DEVICES
CF    FUNCTIONAL STATUS                  [ 0 - 100% ]
DF    OPERATIONAL STATUS                 [ 0 - 100% ]
EF    RELIABILITY FACTOR                 [ 0 - 100% ]
FF    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]
     <ENTERPRISE SENSOR ARRAY DATA>

     RADIATION SENSOR :
GF    FUNCTIONAL STATUS                  [ 0 - 100% ]
HF    OPERATIONAL STATUS                 [ 0 - 100% ]
IF    RELIABILITY FACTOR                 [ 0 - 100% ]
JF    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     GRAVITY SENSOR :
KF    FUNCTIONAL STATUS                  [ 0 - 100% ]
LF    OPERATIONAL STATUS                 [ 0 - 100% ]
MF    RELIABILITY FACTOR                 [ 0 - 100% ]
NF    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     LIFE FORMS SENSOR :
OF    FUNCTIONAL STATUS                  [ 0 - 100% ]
PF    OPERATIONAL STATUS                 [ 0 - 100% ]
QF    RELIABILITY FACTOR                 [ 0 - 100% ]
RF    ENERGY REQUIREMENT                 [ UNITS PER UNIT-TIME; REL: OPSTAT ]

     ATMOSPHERIC SENSORS :
SF    FUNCTIONAL STATUS                  [ 0 - 100% ]
TF    OPERATIONAL STATUS                 [ 0 - 100% ]
UF    RELIABILITY FACTOR                 [ 0 - 100% ]
VF    ENERGY REQUIREMENT                 [UNITS PER UNIT-TIME; REL: OPSTAT ]


          <•••••DATA ASSOCIATED WITH ENEMY SHIPS•••••>

WF   NUMBER OF ENEMY SHIPS
     <DEFENSIVE WEAPONS DATA>

     DEFENSIVE WEAPONS :
XF   NUMBER(WF)
YF   TYPE(WF,XF)
ZF    FUNCTIONAL STATUS(WF,XF)          [ 0 - 100% ]
AG    OPERATIONAL STATUS(WF,XF)         [ 0 - 100% ]
BG    RELIABILITY FACTOR(WF,XF)         [ 0 - 100% ]
CG    ENERGY REQUIREMENT(WF,XF)         [ REL: TYPE ]
     OFFENSIVE WEAPONS :
DG   NUMBER(WF)
EG   TYPE(WF,DG)
FG    FUNCTIONAL STATUS(WF,DG)          [ 0 - 100% ]
GG    OPERATIONAL STATUS(WF,DG)         [ 0 - 100% ]
HG    RELIABILITY FACTOR(WF,DG)         [ 0 - 100% ]
IG    ENERGY REQUIREMENT(WF,DG)         [ REL: TYPE ]

     <ENEMY SHIPS LIFE FORMS DATA>

JG   TYPE OF LIFE FORM(WF)
KG   NUMBER(WF)
LG   INTELLIGENCE LEVEL(WF)
MG    FUNCTIONAL STATUS(WF)             [ 0 - 100% ]
NG    OPERATIONAL STATUS(WF)            [ 0 - 100% ]
```

```
OG   RELIABILITY FACTOR(WF)              [ 0 - 100% ]
PG   HEALTH STATUS(WF)

     <ENEMY SHIPS NAVIGATION DATA>

     LOCATION :
QG   X COORDINATE(WF)
RG   Y COORDINATE(WF)
     VELOCITY VECTOR :
SG   DIRECTION(WF)                       [ 0 - 360 DEGREES ]
TG   SPEED(WF)                           [ 0 - 20 WARP; REL: NAVIGATIONAL CAP
UG   NAVIGATION CAPABILITY(WF)           [ SUB-LIGHT, SUPER—LIGHT ]

     NAVIGATION COMPUTER :
VG   FUNCTIONAL STATUS(WF)               [ 0 - 100% ]
WG   OPERATIONAL STATUS(WF)              [ 0 - 100% ]
XG   RELIABILITY FACTOR(WF)              [ 0 - 100% ]
YG   ENERGY REQUIREMENT(WF)              [ UNITS PER UNIT-TIME; REL: OPSTAT ]

ZG   ENEMY SHIP DETECTABILITY(WF)
AH   AGGRESSIVITY FACTOR(WF)
BH   MISSION(WF)                         [ 0 : NO MISSION, SHIP NON-EXISTENT
                                         [ 1 : CONDITIONAL ATTACK
                                         [ 2 : UNCONDITIONAL ATTACK
                                         [ 3 : ESTABLISH PEACE TREATY
                                         [ 4 : SEARCH AND CONQUER CIVILIZATION
                                         [ 5 : WEAPONS DELIVERY
                                         [ 6 : PEACEFUL CARGO DELIVERY
     <ENEMY CRAFT POWER SUPPLY>

          <•••••DATA ASSOCIATED WITH FEDERATION SHIPS•••••>

DH   NUMBER OF FEDERATION SHIPS
     <DEFENSIVE WEAPONS DATA>

     DEFENSIVE WEAPONS :
EH   NUMBER(DH)
FH   TYPE(DH,EH)
GH   FUNCTIONAL STATUS(DH,EH)            [ 0 - 100% ]
HH   OPERATIONAL STATUS(DH,EH)           [ 0 - 100% ]
IH   RELIABILITY FACTOR(DH,EH)           [ 0 - 100% ]
JH   ENERGY REQUIREMENT(DH,EH)           [ REL: TYPE ]
     OFFENSIVE WEAPONS :
KH   NUMBER(DH)
LH   TYPE(DH,EH)
MH   FUNCTIONAL STATUS(DH,EH)            [ 0 - 100% ]
NH   OPERATIONAL STATUS(DH,EH)           [ 0 - 100% ]
OH   RELIABILITY FACTOR(DH,EH)           [ 0 - 100% ]
PH   ENERGY REQUIREMENT(DH,EH)           [ 0 - 100% ]

     <FEDERATION SHIPS LIFE FORMS DATA>

QH   TYPE OF LIFE FORM(DH)
RH   NUMBER(DH)
SH   INTELLIGENCE LEVEL(DH)              [ 0 - 300 ]
TH   RELIABILITY FACTOR(DH)              [ 0 - 100% ]
UH   FUNCTIONAL STATUS(DH)               [ 0 - 100% ]
VH   OPERATIONAL STATUS(DH)              [ 0 - 100% ]
WH   HEALTH STATUS(DH)

     <FEDERATION SHIPS NAVIGATION DATA>
     LOCATION :
XH   Y COORDINATE(DH)
YH   X COORDINATE(DH)
     VELOCIOTY VECTOR :
ZH   DIRECTION(DH)                       [ 0 - 360 DEGREES ]
AI   SPEED(DH)                           [ 0 20 WARP; REL: TYPE ]

BI   NAVIGATION CAPABILITY(DH)           [ SUB-LIGHT, SUPER-LIGHT ]
     NAVIGATION COMPUTER :
CI   FUNCTIONAL STATUS(DH)               [ 0 - 100% ]
DI   OPERATIONAL STATUS(DH)              [ 0 - 100% ]
EI   RELIABILITY FACTOR(DH)              [ 0 - 100% ]
FI   ENERGY REQUIREMENT(DH)              [ UNITS PER UNIT-TIME; REL: OPSTAT ]

GI   FEDERATION SHIP DETECTABILITY(DH)   [ 0 - 100% ]
HI   AGGRESSIVITY FACTOR(DH)
II   MISSION(DH)                         [ 0 NO MISSION, SHIP NON-EXISTENT
                                         [ 1 CONDITIONAL ATTACK
                                         [ 2 UNCONDITIONAL ATTACK
                                         [ 3 ESTABLISH PEACE TREATY
                                         [ 4 SEARCH AND CONQUER CIVILIZATION
                                         [ 5 WEAPONS DELIVERY
                                         [ 6 PEACEFUL CARGO DELIVERY
     <FEDERATION SHIP POWER SUPPLY>

     ENERGY :
JI   QUANTITY(DH)                        [ 0 - ]

     <GENERAL DATA>
KI   MODULE INITIALIZATION FLAGS(6)
LI   MODULE RUN FLAGS(6)
MI   REAL-TIME CLOCK                     [ STARDATE ; YEAR,MONTH,DAY,HOURS
                                         [ MINUTES,SECONDS,MILLISECONDS ]
```

GLOSSARY

RELIABILITY FACTOR Numerical value indicating the reliability of the associated device. It is used to determine when the associated device will fail.

FUNCTIONAL STATUS A percentage indicating the ability of the associated device to function properly. 100% means it is perfectly functional. 0% indicates complete failure.

OPERATIONAL STATUS Whether a device is operating. Can be either ON/OFF (e.g. phaser) or a percentage level (e.g. shield screens).

Next month I will develop the logic flow for each of the seven modules of the STAR SHIP simulation.

CARD OF THE MONTH

CAÑADA SYSTEMS, INC. PC3200

By Roger Edelson, Hardware Editor

Control A.C. Power Safely and Without Adding Noise to Your Computer

The real problem with the control of external AC power devices is not basically the controller — almost anyone can input a signal to a TRIAC, or an SCR, and connect the load. The problem stems from the necessity to keep the AC power ground separate from the computer ground. This separation is necessary both for reasons of safety and noise immunity.

It is just not good design practice to have power grounds on a chassis that can be touched by an operator; inadvertent reversals of the power plug, or a short (even just high leakage) in the controlled load could produce a hazardous condition for the operator. Also, power line currents flowing in a computer chassis will create very difficult noise problems.

Canada Systems, Inc. has come up with a power control system that answers these two problems, and is also well designed and easy to use. The PC3200 Power Control System comprises a central control logic interaface card (either the PC3216 — a 16 channel controller, or the PC3232 — a 32 channel controller) and as many PC3202 Power Control Units as needed.

Noise immunity and short circuit protection are inherent in the PC3200 system with the use of double isolation to separate the power lines from the computer signals. Power switching is accomplished at the point of control using remote control units. These units have optical coupling on the front end control signals to insure that no AC power signals can get to the computer subsystem. Each channel requires a 2-wire control cable — a current limited control signal and the processor system chassis ground. Optical coupling is also provided on the output of each channel of the Control Logic Interface to eliminate noise coupling. The control signals are, therefore, safe low voltage lines.

Additionally, the Control Logic Interface board is S-100 bus compatible and uses a single peripheral device address to allow independent control of up to 32 channels. A single byte output from the processor selects an individual channel and sets its control state (either off or on) without affecting the state of any other channels. Program control of the PC3200 channels is straightforward, and can be accomplished with a single BASIC statement if the interpreter in use has peripheral I/O capabilities. All-in-all this system provides the microprocessor user an easy-to-use power switching subsystem designed for safety and reliability and S-100 Bus compatibility.

Before going into the kit design and construction let's list the specifications of the two units:

PC3216 — CONTROL LOGIC INTERFACE

MECHANICAL: Single 10" x 5.3" S-100 bus compatible circuit board.

ELECTRICAL: + 8 VDC, 270 ma (max); + 16 VDC, 170 ma with all channels on (250 ma with all channels on and shorted to ground); two times the values for 32 channel PC3232.

ADDRESSING: User selectable to any single peripheral address from 000 to 077, octal.

DATA FORMAT: Single byte output. Bits 0-3 select channel, Bit 7 is on/off control. (Bit 4 word for additional channel select on PC3232).

CONTROL OUTPUTS: Optically isolated from logic. Derived from ± 16 VDC input and current limited to 18 ma per channel.

ACCESSORIES SUPPLIED: 16 Conductor DIP plug-ribbon cable assembly, 25 pin miniature chassis mount receptacle, and mating plug.

PRICE: Assembled, $250.00; Kit $200.00.

PC3202 — POWER CONTROL UNIT

MECHANICAL: 4.75" x 2.5" x 1.6" two-tone grey ABS plastic enclosure with internal components mounted on circuit board.

LINE VOLTAGE: 120 VRMS (140 VRMS max).

LOAD CURRENT: Up to 3.3 amps, internally fused at 3.5 amps.

LOAD POWER: 400 watts (3.3 amps at 120 VRMS).

LEAKAGE CURRENT: 5 ma (max) when control is "off."

ISOLATION: Optical coupling between control and power circuitry rated to withstand 2500 VRMS.

INTERCONNECTION: Input connector for control signal, 2 wire receptacle for load, and integral 2 wire power cord for line (U.L. listed).

ACCESSORIES SUPPLIED: 50' cable with connector.

PRICE: Assembled $50.00; Kit $40.00.

(Prices and specifications subject to change without notice).

Let's take a look at the design and construction of the PC3200 system; starting with the PC3216. The assembly instructions are very complete — ten pages somewhat reminescent of Heathkit type manuals. The parts list and assembly drawing are included in an appendix to the unit reference manual — sort of a strange place to put them during the assembly. However, after the assembly is complete, the assembly manual can be discarded leaving the drawing and parts list attached to the

reference manual — where it now belongs. Construction is extremely easy as we only talking about 13 I.C.'s and maybe 50 other components. The board can be completed in about a half-hour if you don't stop for coffee and dessert. Perhaps the longest time is taken by building the cable. The printed circuit board has gold-plated edge connectors, and is nicely tinned. There is only a minimum amount of component identification as the board is not screened — the information is part of the etch. The board is not solder masked, which means that you have to be somewhat careful during the soldering operations. But as the board is not very complex the assembly is not difficult. All the I.C.'s and the cable are socketed — though I have seen better sockets. Jumpers are used for address selection and function adequately, though I would have preferred a P.C. switch to allow for ease in changing addresses when I change my system configuration. Figure 1 shows the layout of the PC3216 board, and Figure 2 is the schematic diagram of the board.

Ignoring the address selection circuitry for the minute we can draw a simplified schematic of one of the control channels, as shown in Figure 4. A control channel consists basically of a control D-type flip-flop (part of a 9334) connected through a current setting 120 ohm resistor to the LED portion of an optical isolator (part of an ILQ-74). The output of the phototransistor portion of the

NAME	VALUE	LOCATION
R1	4.7K	X2
R2	120	X2
R3-R10	680	X4
R11-R18	680	X5
R19-R26	120	Y2
R27-R34	120	Y4
R35	4.7K	Z6
D1	IN4742	X1

NAME	VALUE	LOCATION
C1, C2	47	X1
C3	.047	X2
BC1, BC2	.047	Y1, Y4
BC3, BC7	.047	Z1-Z6
VR1	7805	X1
Q1	MJE520	X2
Q3	2N3904	X2
Q4	2N3904	Y5

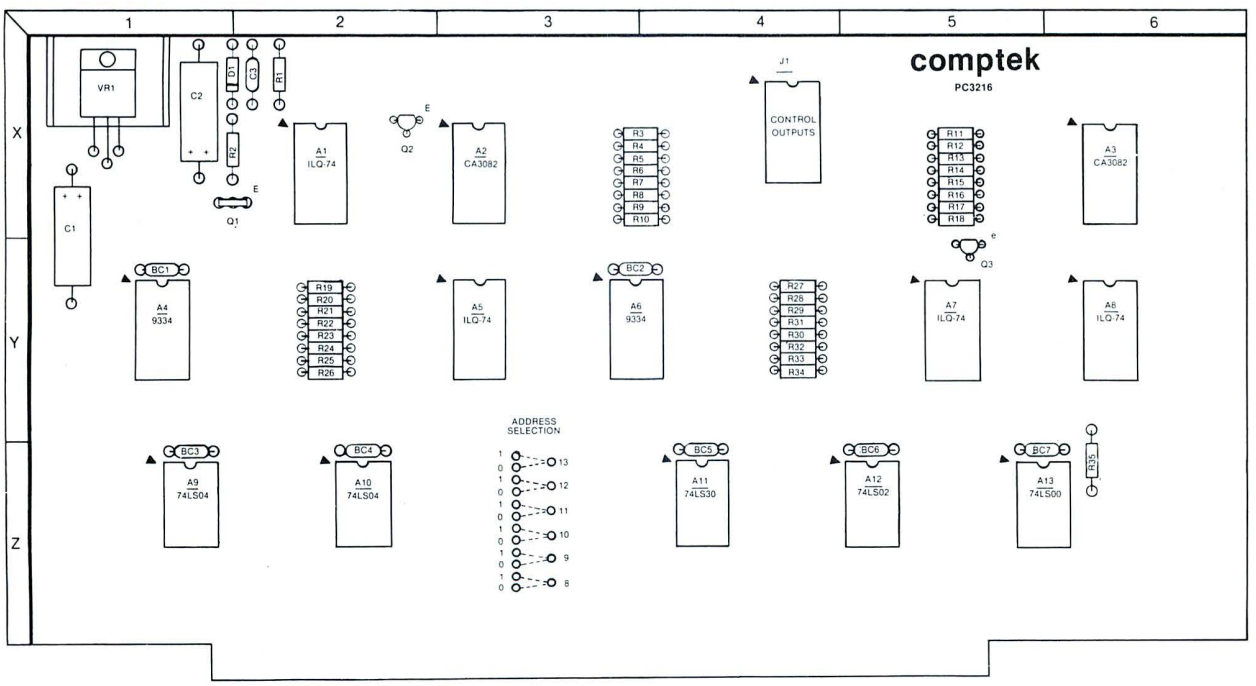


Figure 2. PC3216 Comptek Assembly

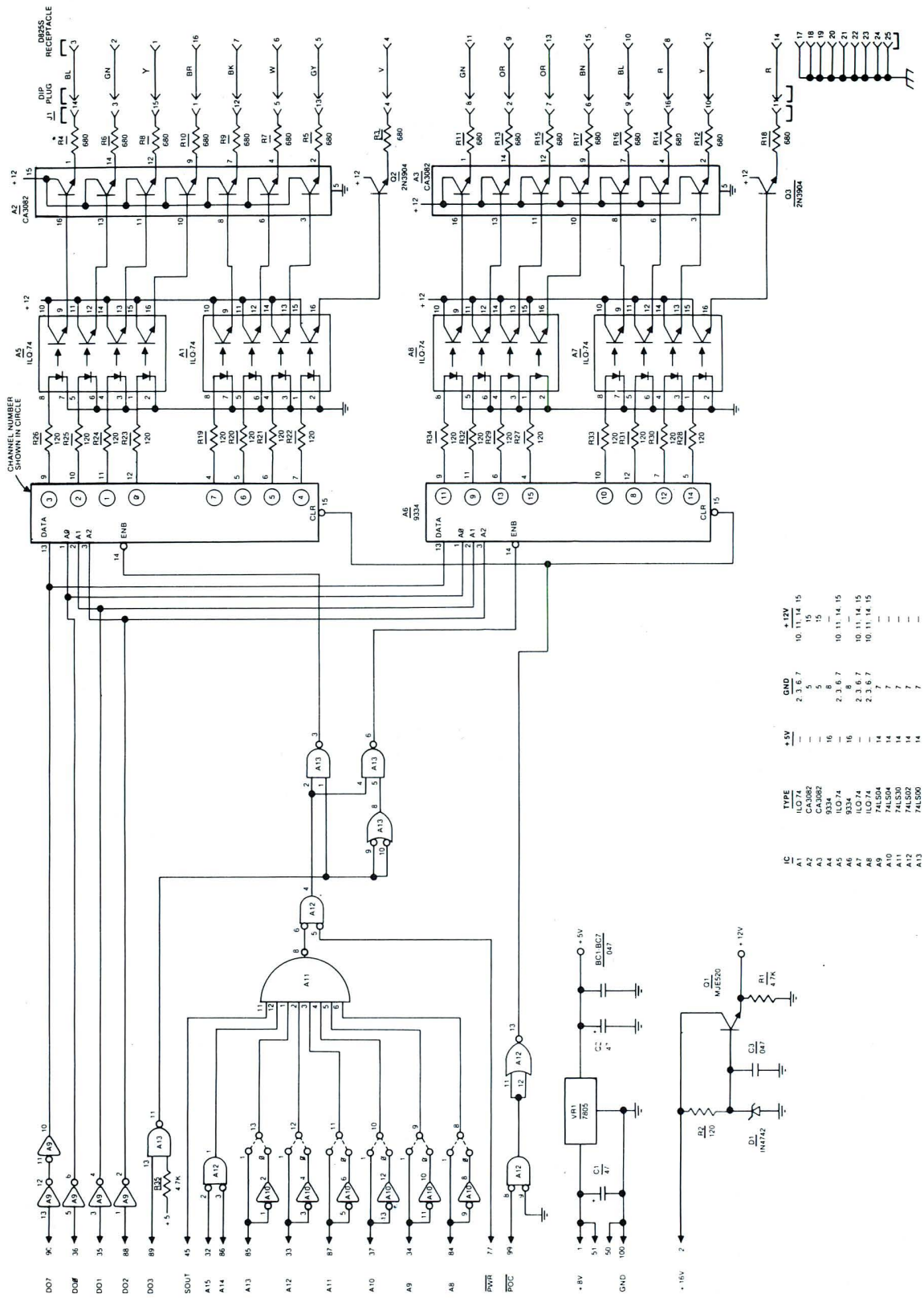
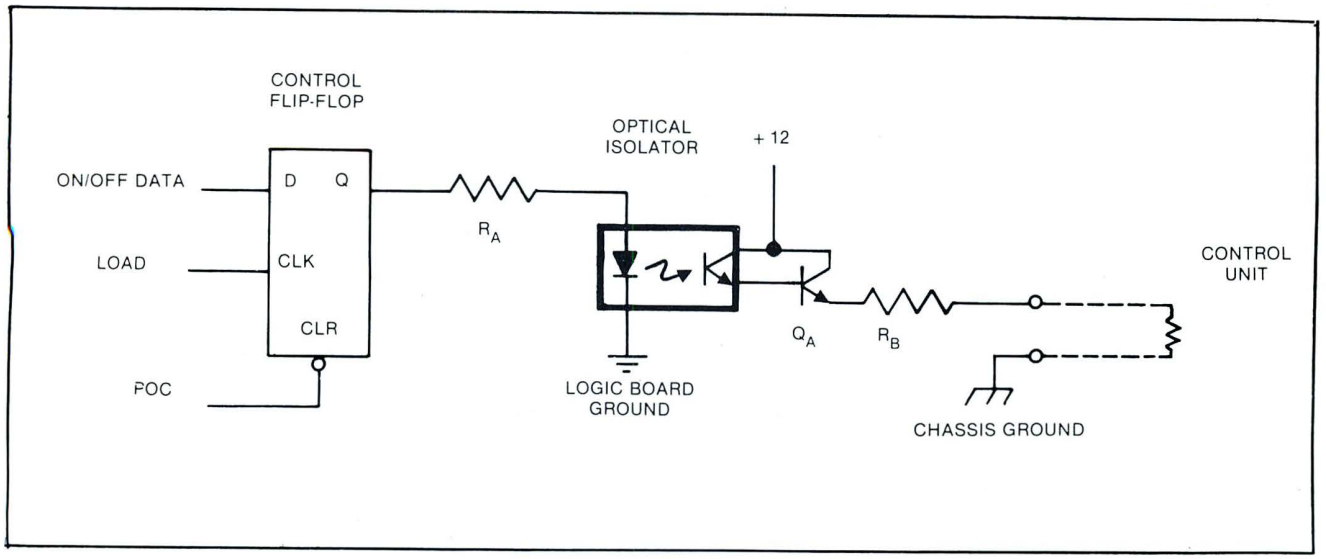


Figure 3. PC 3216 Power Control Logic Interface



optical isolator drives an emitter follower (⅐ of a CA3082).

POWER

During power up, the $\overline{POC}$ signal clears the control flip-flop, ensuring that the channel will start in the off state. Thereafter, whenever the control flip-flop receives a load pulse, it will be set if the ON/OFF DATA = 1, and cleared if the ON/OFF DATA = 0. Whenever the control flip-flop is set, it routes current form the +5V power supply out of the Q output, through R_A, to turn on the Light Emitting Diode (LED) in the optical isolator. The phototransistor section of the optical isolator senses the LED light, and allows current to flow from the +12V supply to the base of Q_A. The isolator output transistor, and Q_A are connected as a Darlington stage for increased output current drive capability. Current from the +12V supply flows through Q_A, R_B, and the external control unit, then returns to the supply through the processor chassis ground.

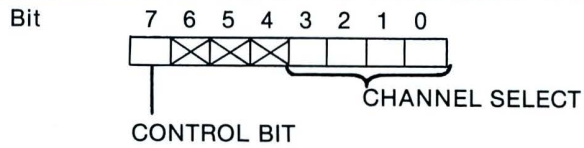
RESISTANCE

R_B has a value of 680ohms, which allows 5 volts to be developed across any external control input with a nominal 500 ohms input resistance. Under these conditions, a current of 10 ma flows through R_B and the external control input. R_B also serves to limit the short circuit output current to approximately 18 ma.

CONTROL

All 16 control flip-flops are contained in two 9334 I.C.'s (A4 and A6). These I.C.'s consist of eight type D flip-flops with common data, and clear inputs. Addressing is done through the independent clock inputs. An *enable* pulse on pin 14 will be routed to one of the eight flip-flop clock (load) inputs, according to the 3 bit flip-flop select input on pins 1, 2, and 3. These select bits are derived from DATA OUT lines DO0, DO1, and DO2, while line DO3 determines, through A13, which 9334 receives the *enable* pulse. An output to the PC3216 is sensed by A11, according the address jumpers. A12, pins 2 and 3 require the 2 most significant address lines to be low, while the address jumpers and A10 decode one of the 64 possible combinations for the remaining six address lines. When the jumpered address is seen on the bus, and the OUTPUT status signal (SOUT) is high, A11-8 goes low, is "ANDED" with the processor write pulse (PWR) by A12, and routed to the proper 9334 according to the present state of DO3.

The 16 control channels of the PC3216 are all accessed through a common peripheral address, as set up through the board jumpers. The format for the commands is shown below:



The channel select is done by the lowest 4-bit field of the byte. The selected channel is simply the decimal equivalent of the 4-bit binary number represented by bits 0-3 (bit 0 is the LSB). Bit 4 is used to obtain 32 channel control on the PC3232.

Control bit (bit 7) is used to command the selected channel into the desired state. A "1" in this bit will cause the selected channel to be turned on, while a "0" will turn the channel off.

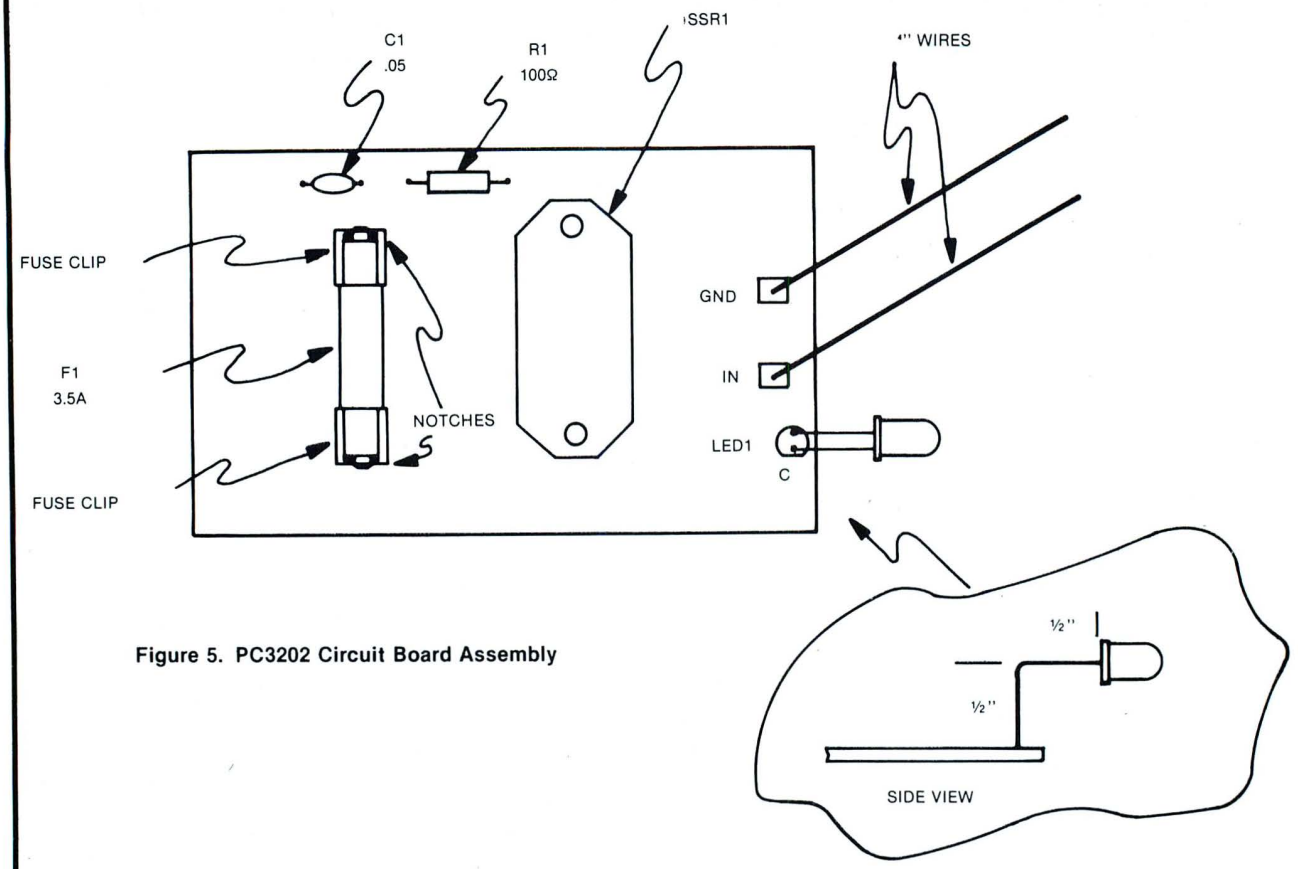


Figure 5. PC3202 Circuit Board Assembly

Figure 5. PC3202 Circuit Board Assembly

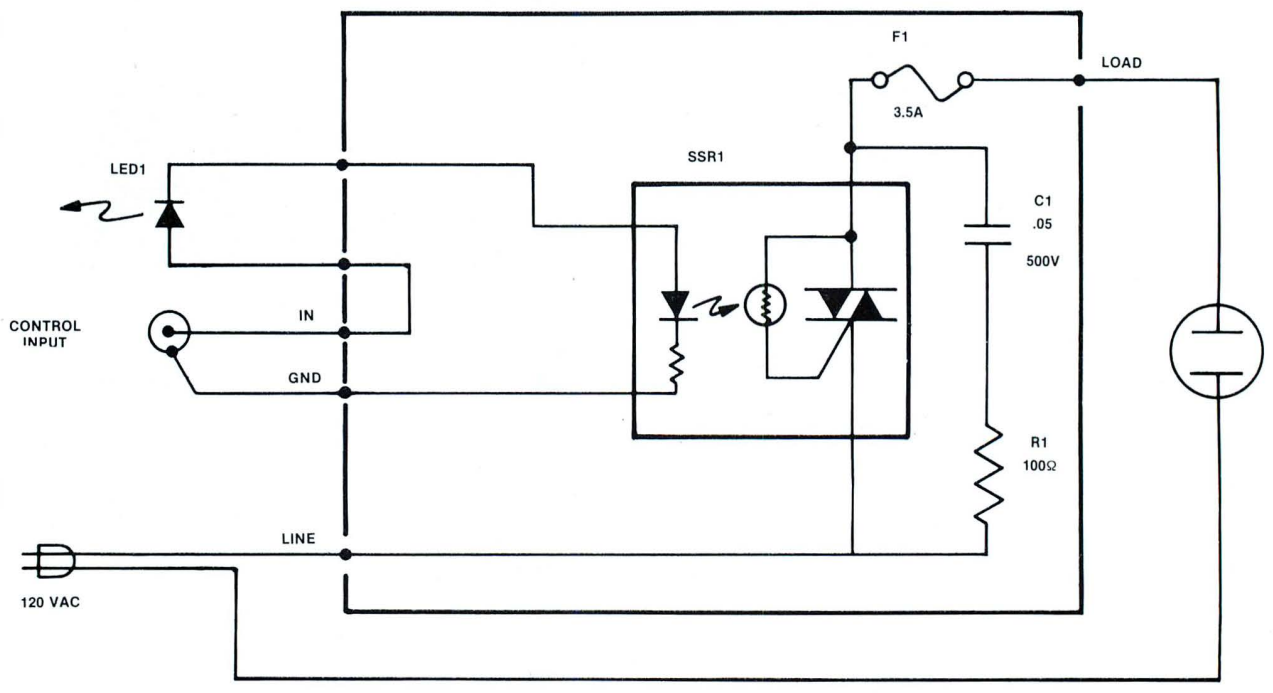


Figure 6. PC3202 Power Control Unit

Assembly language programming of the PC3216 consists simply of placing the binary channel code in the accumulator, zeroing or setting bit 7 to turn the channel off or on, respectively, and executing an OUT XXX instruction, where XXX is the PC3216 address.

Any control output to the PC3216 has two components a channel select and an on/off control. Programming in higher level languages, such as BASIC, is quite simple when these two components are determined independently, and then added before output to the PC3216. The on/off control is bit 7, which, if set, has an equivalent decimal value of 128 ($2^7 = 128$). Because the channel select field is located in the least significant bits of the output command, the channel number, when converted from decimal to 4-bit binary, will be the correct channel code required by the PC3216. This means that outputting a channel number to the PC3216 will turn that channel off, and outputting 128 plus the channel number will turn the channel on.

Following is a sample program, written in ALTAIR™ 8K BASIC, to turn any channel on or off. The PC3216 has been *jumpered* for address 40, octal, which is equivalent to 32, decimal.

```
10 PRINT "INPUT CHANNEL
   NUMBER";
20 INPUT C
30 PRINT "ON OR OFF";
40 INPUT X$
50 IF X$ = "ON" THEN OUT
   32,128 + C : GOTO 10
60 IF X$ = 'ON" THEN OUT
   32,128 + C : GOTO 10
70 PRINT "???"
80 GOTO 30
OK
```

The PC3202 Power Control Unit is remarkedly non-complex, consisting as it does of only five components — a fuse, one resistor, one LED, one capacitor, and the solid state relay. All of these components are mounted on a printed circuit board. The board itself is mounted in a grey plastic box which also serves to hold the controlled A.C. receptacle, the socket for the input control line, and the strain relief for the A.C. cord. All of the components associated with the power line, including the solid state relay are U.L. listed. Figure 4 shows the layout of the P.C. board, and the circuit diagram is given in Figure 5.

The operation of the power control unit is extremely simple: when the particular power control unit has been selected to the turned "ON" by the Control Logic Interface, a current of about 7 ma flows into the PC3202 control signal input. This current turns on the LED to provide the operator with a visual indication of the state of the control unit and also energizes the internal LED of the optically isolated Solid State Relay. Also internal to the SSR is a photosensitive resistor which upon sensing the control LED decreases in resistance and supplies turn-on current to the TRIAC portion of the SSR. The TRIAC is connected in series with A.C. line and the load, and when turned on allows current to flow through the load.

A resistor capacitor filter is used to suppress transients arising from inductive loads which might (if the voltage rate of change were higher) keep the SSR "ON" even though it had been commanded 'OFF." A series 3.5 Amp fuse is provided for overcurrent protection.

Construction of the PC3202 is a snap and need not be covered here. In less than an evening I had the Control Logic Interface and the Power Control Unit up and functioning with no problems. Had I experienced difficulties, CANADA SYSTEMS has included a very thorough troubleshooting section.

The PC3200 Power Control System operates smoothly and easily. I plan to use it in conjunction with a real-time clock (to be reported on at a later date) to control my darkroom enlarger and also in a household security and maintenance system.

AN ADVANCED DISC-BASED SYSTEM

by Michael Busch and Dan Gaines

There comes in the life of all hobby computerists the traumatic moment when the novelty of vanquishing squadrons of Klingons and delving into the mysteries of biorhythm theory begins to wear a little thin. And so it was, some months ago, that the authors began to search for a high-performance low-cost microcomputer system for serious business applications.

BACK TO BASICS

From experience in developing on-line business applications on minicomputer-based business systems, we knew that the key to successful business applications is fast file manipulation, *not* fast CPU performance. Proof of this can be found by looking at the BASIC/FOUR, one of the finest small business systems available in the $40,000+ category. Believe it or not, this minicomputer executes BASIC programs at a speed which is slower than most microprocessor BASIC interpreters, yet its relatively fast disc hardware and its excellent file management software permit the BASIC/FOUR to perform exceptionally well in a business applications environment.

Thus it was clear to us that an 8-bit microprocessor would be entirely adequate for our requirements. We were especially attracted to the Zilog/Mostek Z-80, not because of its high speed (which we did not really need) but because its extensive instruction set permits programs to occupy significantly less memory space than do other MPUs.

We were also convinced that it would be very advantageous to build our system around the S-100 bus, in order to provide maximum flexibility for future growth. To minimize the cost of memory and to eliminate the need for shielding and terminating the bus, it was decided to run the Z-80 at a conservative 2 MHz clock rate. Although a number of good Z-80 CPU boards are available for the S-100 bus, we determined that the one distributed by S. D. Sales Co. (Dallas, TX) was an exceptionally fine design and an outstanding bargain.

Now we faced a most critical decision: the selection of mass storage hardware and associated file management software. Even during our Startrek/Biorythm activities, it had become painfully clear that magnetic tape was a marginal medium even for program storage, and wholly unacceptable for manipulation of data files. On the other extreme, it was apparent that hard disc prices had not yet reached an affordable level. Floppy disc technology seemed to offer the best compromise between cost and performance, so we began to investigate the alternatives available to us in this area.

SORTING OUT THE FLOPPIES

It did not take us long to figure out that a two-drive diskette system was the minimum that we could consider, since a single drive would preclude disc-to-disc copying (for file back-up, etc.). We found that the total cost of a two-drive system which included all of the essentials (drives, controller, power supplies, cabinets, cables, and software) fell consistently in the $2,500 to $3,000 range for standard 8-inch floppies, and around $1,500 for 5.25" minifloppies. The minifloppy, at nearly half the price of others, seemed like quite a bargain until we realized that the mini had only one-third of the capacity of a standard floppy (89K bytes versus 250K to 300K bytes), and that its performance in a random-access application was three to six times slower (see Table 1). While the minifloppy is an excellent vehicle for storing programs and small sequential data files (i.e., a high-speed replacement for cassette tape), we decided that it was not suited to the needs of our applications.

Diskette Drive (Positioner Type)	Min. Seek (ms)	Max. Seek (ms)	Average Latency (ms)	Average Access (ms)	Average Accesses per sec.
PerSci 277 Dual (linear motor)	10	95	83	136	7.4
Shugart SA850 (3ms stepper)	18	243	83	214	4.7
iCOM, Wangco (6ms stepper)	18	468	83	326	3.1
Shugart SA800 (10ms stepper)	18	768	83	476	2.1
Shugart Minifloppy (40ms stepper)	50	1370	100	810	1.2

Notes:
(1) Seek times include settling time.
(2) Average access time = average latency time plus average of min and max seek times.
(3) Average accesses per second = reciprocal of average access
(4) Seek, settling, and latency times obtained from manufacturers' specifications.

Table 1. Performance of floppy disc drives.

In comparing the available 8-inch diskette drives, we were surprised to find such a wide range of performance parameters within such a narrow range of prices. The drives manufactured by PerSci, Inc. (Los Angeles, CA) not only performed much better than any of the other available drives, but also outperformed the newly-announced Shugart SA850 "Fasflex" drive (not yet avail-

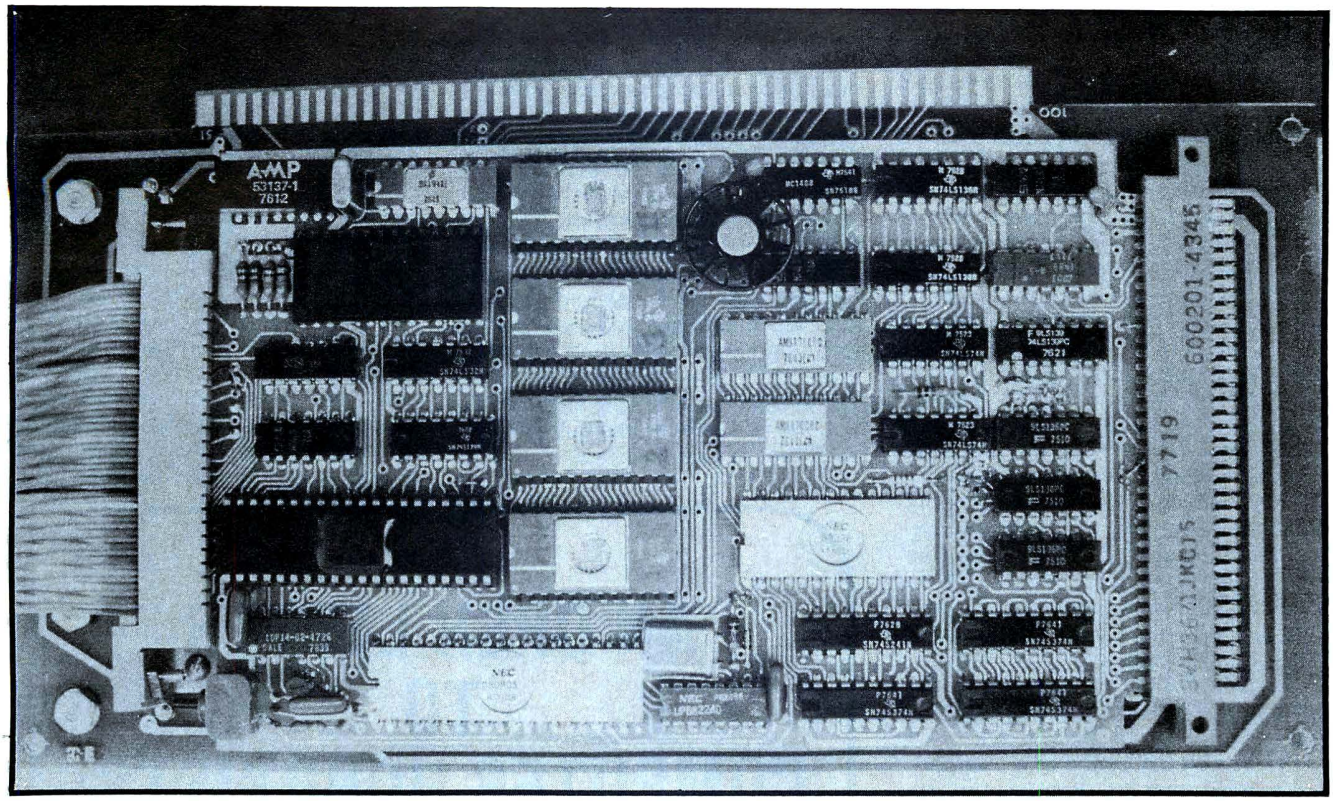
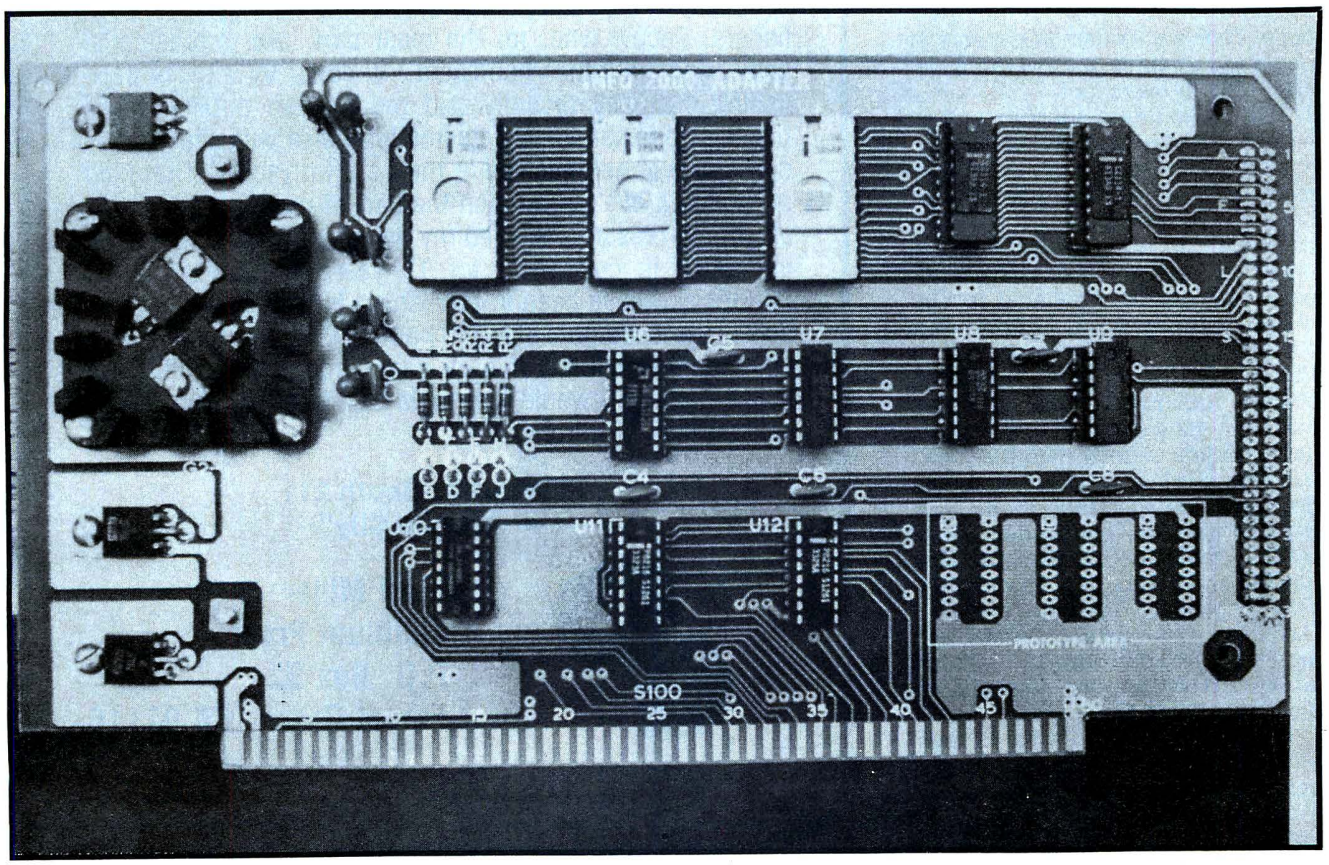


Figure 1. PerSci Model 1070 Intelligent Diskette Controller mounted piggyback on an INFO 2000 Adapter board for the S-100 bus.

Figure 2. INFO 2000 Adapter board mates the PerSci controller to the S-100 bus, includes: 3K of EPROM and 1K of RAM for the Disc Monitor, plus power regulation and interfacing logic for the controller.



able at the time of this writing). We decided to pay a visit to PerSci to find out how they do it. We were exceedingly impressed by what we saw.

STAIRS AND ELEVATORS

Most floppy disc drives, it turned out, use a positioning mechanism consisting of an incremental stepping motor which drives a lead screw along which the record/ playback head travels. The operation of a stepper-type positioner can be likened to running up a flight of stairs. Each seek operation consists of a sequence of track-to-track steps, followed by a settling period during which any head vibration has the chance to die down. Each step requires between six and ten milliseconds depending on the make and model of the drive (the minifloppy requires 40 ms per step), and the settling time is between eight and fifteen milliseconds (the faster the stepper, the longer the settling time). A maximum seek (76 tracks) takes 76 times as long as a minimum seek (1 track) if settling time is not considered.

The maximum speed of a stepper-type positioner is limited by its mechanical inertia. If the stepping motor is driven too fast, it may overshoot the desired track when the stepping pulses are removed. The newly-announced generation of floppy disc drives typified by the Shugart SA850 reduces inertia by doing away with the lead screw. The stepper motor drives the head carriage by means of a capstan and a taut steel band. This mechanism is capable of operating at three milliseconds per step without overshoot.

The PerSci drives are built with an entirely different type of positioner, a miniaturized version of the linear motor (also called "voice coil") positioning mechanisms which are used universally in large-scale hard-disc drives. The operation of this kind of positioner can be compared to that of an elevator in a 77-floor skyscraper. The head carriage in a PerSci drive travels along a track on almost frictionless ball bearings. During a long seek operation, the linear motor accelerates the head carriage to very high speed, and then gradually decelerates it as the desired track is approached. As a result of the smooth deceleration, no additional settling time is required. This mechanism is about twice as fast as a stepper on short seeks, and increases its advantage to as much as eight times on long seeks as indicated in Table 1.

Another feature of PerSci is their Model 277 dual diskette drive, which combines two floppy disc drives into a package the same size as an ordinary single drive. The 277 dual drive shares a single positioner and a single spindle motor between the two floppy discs. Of course, sharing one positioner results in some performance penalty: the PerSci dual drive is not quite as fast as two PerSci single drives (Model 70s), but it will handily outperform two of anybody else's drives in most applications. The dual drive is smaller and less expensive than two singles, and has drastically reduced power consumption (28 watts for one PerSci dual compared with 140-180 watts for two Shugart or Wangco singles). In fact, the device operates quite happily without any cooling fan.

DOUBLE TROUBLE

We next looked into the pros and cons of hard sectoring and double-density recording. Both are techniques for increasing the capacity of a floppy disc.

Hard sectoring makes use of a special type of diskette which has thirty-two sector holes punched in a circle surrounding its large center hole. These are used to define thirty-two 128-byte sectors on each track of the diskette. In contrast, IBM-compatible soft sectoring identifies twenty-six 128-byte sectors per track by means of magnetic headers recorded on each track. While hard sectoring provides six extra sectors

on each track, soft sectoring is more flexible, has greater immunity to errors, and offers compatibility with a wide variety of computer systems and data entry devices. Either technique seemed acceptable for our needs.

Ordinary IBM-compatible single-density recording uses a simple technique called "double frequency" or "FM" recording. FM is similar in some respects to the biphase recording technique used by some hobbyist cassette interfaces (e.g., Tarbell) in that it is self-clocking and relatively immune to variations in speed and to media defects. Double-density recording has been successfully accomplished by means of several sophisticated encoding techniques (known as "MFM," "M²M," and "GCR"). Each of these techniques make it possible to record twice as much data on a diskette, but all of them are much less tolerant of speed and alignment errors, dirty heads, marginal diskettes, etc. After soliciting expert advice from several sources, we decided to forego double-density recording on the grounds that we'd rather drive a healthy Ford than a sick Ferrari!

Further to complicate the issue, dual drives and double-density recording has recently been joined by two new notions called double-sided recording and double-track recording (see "Double Talk" box). Double-sided recording was recently demonstrated by Shugart, PerSci, and others at the National Computer Conference. It provides doubled capacity without any of the compromises of double-density recording, and will be available to hobbyists next year. Double-track recording doubles the number of tracks on each disc surface, but it will not be available until mid-1978 and its reliability is not yet well understood.

DOUBLE TALK

Floppy disc manufacturers talk of four distinct methods of doubling the storage capacity of a single drive, and the terminology can get quite confusing:

DUAL DRIVE: Two drives packages in a single unit with certain common components shared between them.

DOUBLE DENSITY: Data recorded on each track at twice the standard density, by means of either MFM, M²FM, or GCR encoding.

DOUBLE SIDED: Data recorded on both sides of a diskette, using specially certified media and two independent heads. Announced in June 1977, and soon to be available.

DOUBLE TRACK: Twice as many tracks recorded on each disc surface (154 tracks instead of the standard 77). Not yet announced.

To make matters even more confusing, a floppy disc system can employ combinations of these techniques to multiply storage capacity by four, eight, or sixteen. One manufacturer has used the phrase "quad density" to refer to a combination of double density and double track recording. All we can say is: watch your terminology.

HOW SMART SHOULD A CONTROLLER BE?

Having settled on the PerSci 277 dual drive and single-density recording, we next had to select a suitable controller. Several alternatives presented themselves. Alpha Microsystems, Processor Technology, and Tarbell Electronics all sell controllers which mate the PerSci drive to the S-100 bus. These are fairly simple devices which require extensive software support in the host microcomputer amounting to several thousand machine instructions. PerSci also supplies a controller of its own, a sophisticated "intelligent" controller, and the more we studied it the more we became intrigued with its potential.

The PerSci Model 1070 controller is a remarkable piece of engineering. Built on a tiny 4.5-inch by 7-inch circuit board (see Figure 1), the device incorporates an 8080 microprocessor and associated support chips, a Western Digital FD1771B single-chip LSI diskette controller (see INTERFACE AGE, October and November 1976 issues), 4K bytes of ROM or EPROM containing file management firmware, 1K bytes of RAM used for input/ output buffering, an 8-bit parallel microcomputer interface, and an optional RS232 serial interface. In short, the PerSci controller is a one-board computer devoted to managing the disc subsystem. The controller was not designed for the S-100 bus specifically, but we determined that interfacing it to S-100 was a simple matter requiring only three cheap ICs.

FIRMING UP THE FIRMWARE

The matter of controller firmware was not so simple. The exciting thing about an intelligent controller like the PerSci 1070 is that the controller's own firmware can take care of all of the complexities of controlling the drives and managing disc files. To the host microcomputer, the disc subsystem looks no more complicated than, say, a paper tape reader. This makes it exceptionally easy to use the disc with existing non-disc-oriented monitors, language processors, and other software.

We were disappointed to find that the existing firmware supplied with the PerSci 1070 controller was not very well suited to our requirements. But the concept and the engineering of the controller was so appealing to us that we hated to pass it up. Therefore, we approached PerSci and proposed to perform a complete rewrite of the controller firmware for them. The new firmware would support the following functions: diskette format initialization with optional sector interleave; maintaining and searching a directory of files on each diskette; allocation, de-allocation and reclamation of diskette space; sequential, random, stream and direct file access methods; blocking and unblocking of both fixed-length and variable-length records; creating, deleting, renaming and copying of files; error detection and error re-try; and diagnostic testing of the diskette drives.

PerSci agreed, and the usual development steps ensued with their good and bad days. Three months later the new firmware was fully operational.

FLASHBACK TO THE Z-80

In the meantime, we searched for the best base of existing software to use with our system. We surveyed much of the available disc-oriented software such as Altair, Processor Technology, and Northstar Disc BASICs, Digital Research CP/M, Administrative Systems Inc. OPUS/ONE, but we were less than satisfied with all of them for reasons of inflexibility, performance, and/or large memory requirements.

At length the best library of program development software that we found turned out to be the non-disc-oriented software distributed by Technical Design Labs (Princeton, NJ). The TDL library includes 8K BASIC and 12K Super-BASIC interpreters, an ANSI FORTRAN compiler, a powerful text editor similar to DEC's well-known TECO editor, an excellent word-processing system, and probably the best macro-assembler available on any microcomputer system. All of TDL's software has been written expressly for the Z-80 to take advantage of its powerful instruction repertoire. Furthermore, TDL's software development staff consists of a half-dozen computer scientists at MIT who really know what they are doing.

Because all TDL software is written without embedded input-output routines, and depends upon calls to the monitor to perform all input-output operations, we felt

that it would not be too difficult to marry the TDL software to a disc-oriented environment.

PUTTING IT ALL TOGETHER

Having decided to combine the S-100 bus, the Z-80 microprocessor, and the PerSci 277 drive with the 1070 intelligent controller, and TDL software, we faced a big task. Somehow we had to make all of these pieces work together. It turned out to be easier than we feared.

First came the task of interfacing the PerSci 1070 controller to the S-100 bus. To do this, we mounted the controller board piggyback on an S-100 prototyping card, added a few ICs and regulators, and wire-wrapped all into a reasonably presentable package. To our astonishment it worked the first time!

Next we had to get the disc working with BASIC and the other TDL software. Starting with TDL's paper-tape-oriented ZAPPLE monitor, we added patches to make available the full set of disc operations implemented in controller firmware, and to permit assigning disc files as the logical "reader," "punch," and "list" devices. This worked extremely well, but as the patches became more and more extensive, we finally decided to start with a clean slate and write our own TDL-compatible disc monitor.

Initially, the monitor was executed from EPROM on a Bytesaver board, and used the top several hundred bytes of RAM for stack and working storage. Eventually, we added 3K of EPROM and 1K of RAM to our wire-wrap piggyback board, thereby creating a completely self-contained hardware/firmware/software system on one board.

The final step was to modify TDL BASIC to permit full manipulation of disc files by BASIC programs. Because of the simple interface afforded by the intelligent disc controller, it required less than 100 bytes of software to add file handling to BASIC! The addition simply permits the PRINT and INPUT statements to be used with the disc as well as the console.

Everything was working fine. With the warm feeling that accomplishment brings, we set to work developing the disc-oriented applications which had motivated this whole train of events — with occasional Startrek breaks, you understand . . .

INFO 2000 IS BORN

The three Princes of Serendip are still amongst us. Some PerSci employees who were themselves computer hobbyists asked whether we could set them up with adapter boards and software of our design. After receiving a few other requests of a similar nature, we demonstrated our system at the First West Coast Computer Faire in San Francisco, and found much interest. So we took the logical next step.

We contracted with a first-rate circuit board house to make up the S-100 adapter cards, (see Figure 2), then added some enhancements to our disc monitor, and produced extensive user documentation for it (using the TDL editor and word-processor, naturally). To support and distribute these products, we started a company called INFO 2000.

Today our system and software are being used in more than 100 installations throughout the United States, and are on display in a growing number of computer stores. We have added an INFO 2000 adapter board for the Digital Group Z80 computer alongside our S-100 product, so that the PerSci disc and the TDL software library can be used on Digital Group systems. The editor warned us not to boast, but we do feel proud. We believe we have designed a good product.

PERSCI 1070 INTELLIGENT FLOPPY DISK CONTROLLER

By Robert A. Stevens

FOREWORD

This article is the first article of a two-part series covering PerSci's Model 1070 Intelligent Floppy Disk Controller and Model 70 and 277 Floppy Disk drives. The first article covers the 1070 Intelligent Floppy Disk Controller functional architecture in detail and includes a logical interface design for integrating PerSci's Controller and Floppy Disk Drives into your S-100 bus 8080 microcomputer system.

INTRODUCTION

The Model 1070 Controller is the first and still the only truly intelligent diskette controller with its own 8080 microcomputer, two memory ports and a file type disk operating system capable of being interfaced to any microcomputer. The 1070 controller provides on-board capabilities to communicate by file name with most microcomputers and at the same time, takes care of all housekeeping functions. One controller board controls up to four PerSci Model 70 single diskette drives or up to two PerSci Model 277 dual diskette drives, providing a high-performance mass storage subsystem with an on-line date storage capacity of more than one million bytes. For reference, see Figure 1.

MAJOR INTELLIGENT CONTROLLER FEATURES

The common denominator 1070 Controller PCB provides the following on-board major features when fully populated with all options:

- Controller configured as a dedicated general purpose 8080 microcomputer.
- Controller mechanized with Western Digital's single chip floppy disk controller LSI IC.
- Co-ordinated handshaking programmed I/O parallel data transfer between controller and host computer allows all types of data access and transmission formats.
- Provides ASCII Text, ASCII HEX object code & executable binary object code storage formats.
- Provides four data access storage transmission formats (direct access, stream access, relative access & punctuated access).
- Controller mechanized with two host computer memory ports.
- Two memory port controller can be interfaced to any host computer via the high speed & bit parallel memory port or via the optional RS232 serial asynchronous memory port.
- Controls up to four PerSci Model 70 Single Diskette Drives or up to two PerSci Model 277 Dual Diskette Drives.
- Can be utilized to control other manufacturer's equivalent floppy disk drives without hardware or PDOS modifications.
- On-board 1K byte static RAM communication data buffer storage memory provides data transfers between host computer and diskette without passing the critical *read/write* timing parameters associated with the disk drive to the host computer.
- On-board microcomputer with ROM Resident PDOS FMF resolves problem of requiring a different DOS for every type of computer CPU interfaced to.
- Host computer requires only a minimal I/O driver routine unique to its CPU to complete the total DOS software requirements (168 bytes in a typical 8080 based microcomputer system).
- Resident PDOS FMF can be customized to special applications without redesigning hardware (although not a standard option, this capability does provides means of customizing the controller to meet special situations for quantity orders).

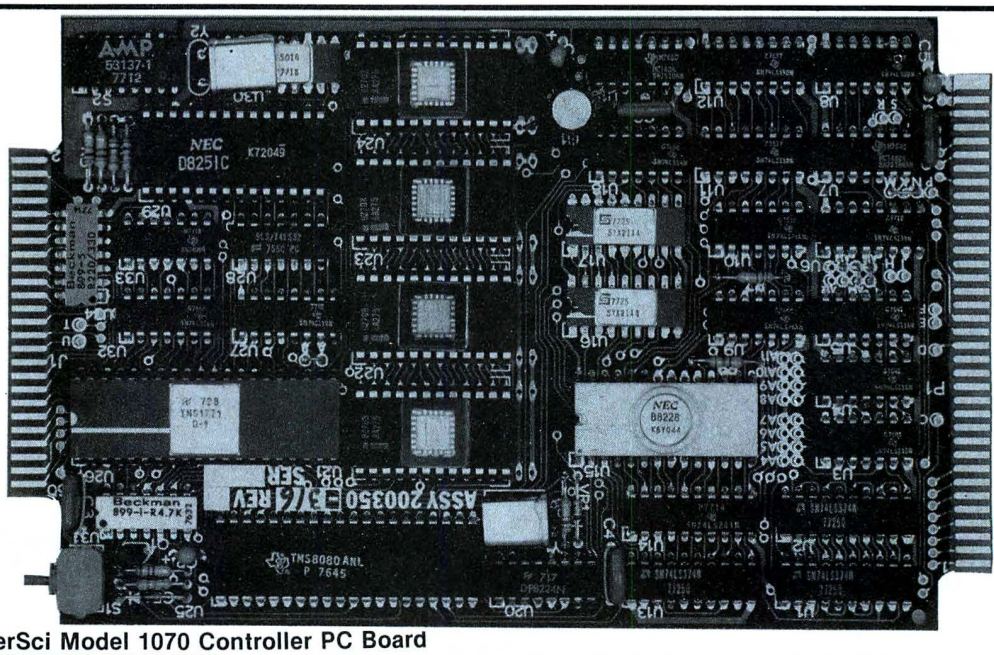


Figure 1. PerSci Model 1070 Controller PC Board

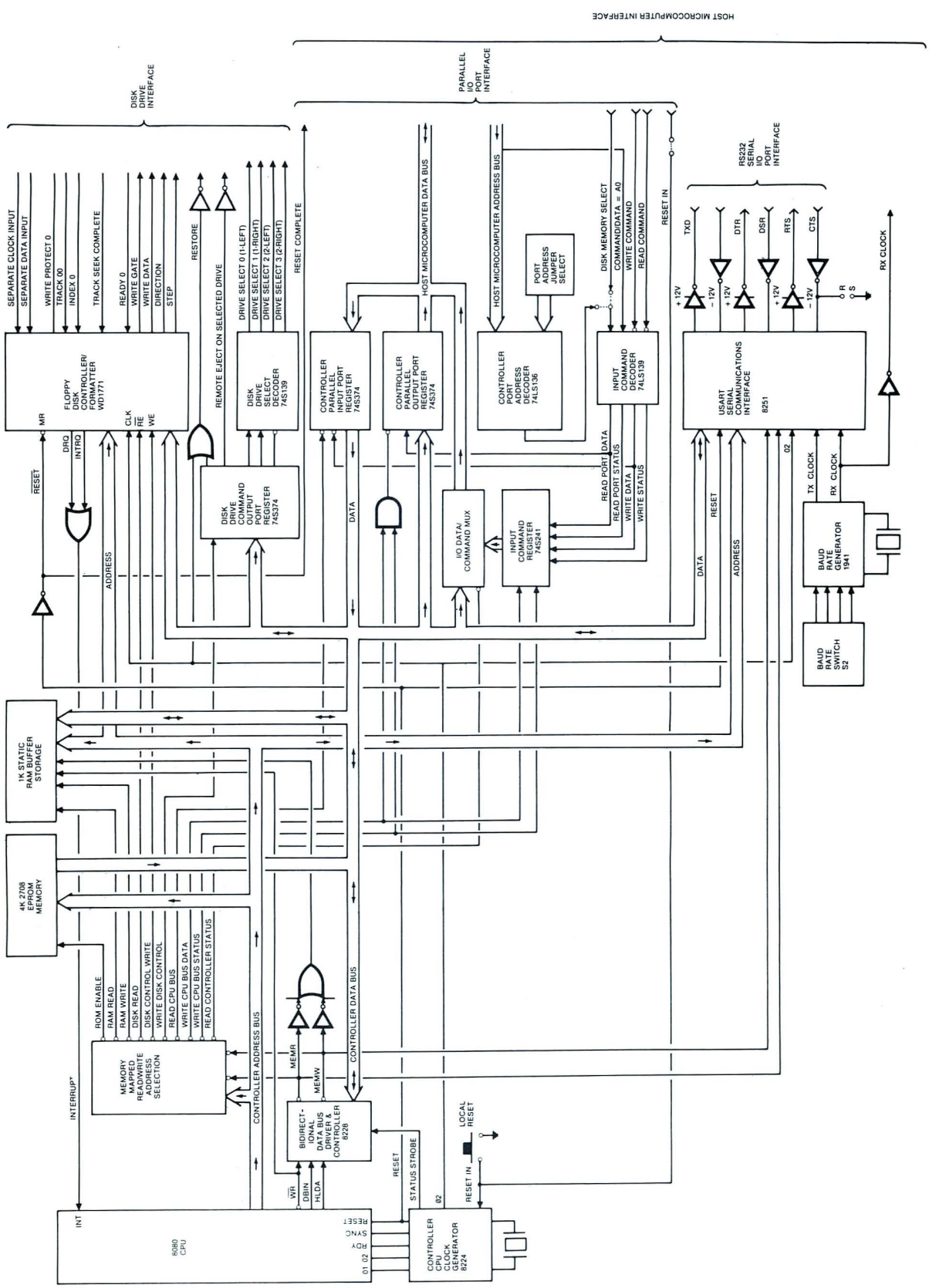


Figure 2. Model 1070 Intelligent Floppy Disc Controller Functional Block Diagram

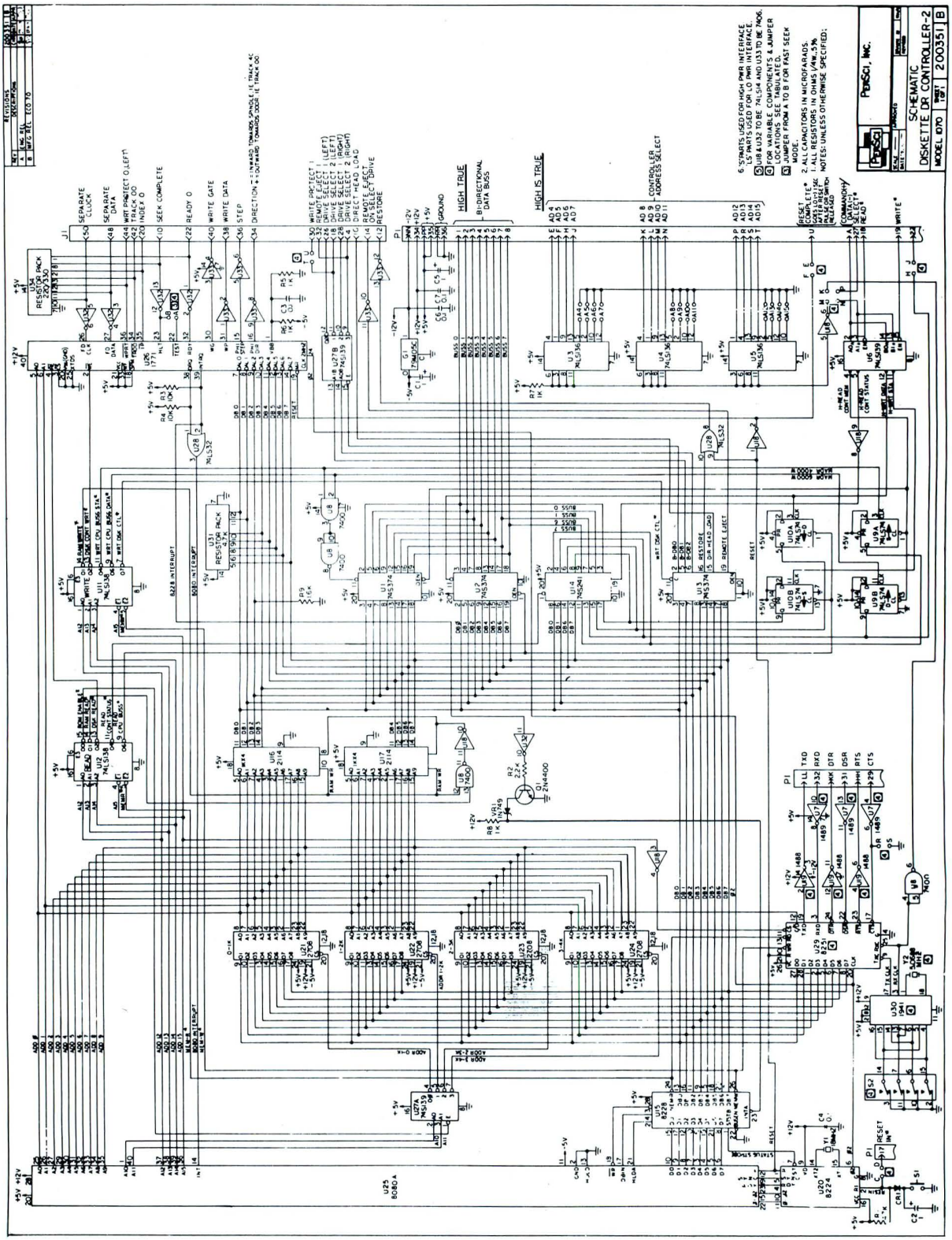


Figure 3. Model 1070 Intelligent Floppy Disk Controller Logical Program

- PerSci's PDOS FMF Modified IBM soft sectored disk storage format allows 76 tracks available for file data storage and permits up to a 100-file index table on a single index track.
- PDOS FMF allows up to 252,928 bytes of data storage/single sided diskette volume.
- IBM 3740 Soft Sectored Disk Storage Format available as an option.
- PDOS FMF Diskette Initialization function provides choice between non-interleaved and twelve optional interleaved sector sequences.
- PDOS FMF allows up to five open files to exist simultaneously.
- PDOS FMF manipulates diskette files by name yet requires no more software support in your host microcomputer than does a paper tape reader or cassette tape recorder storage system.
- PDOS FMF provides Write Error Detection and Auto Retry on soft errors.
- PDOS FMF provides operator error and disk drive diagnostic messages.
- Operates on standard microcomptuer voltage levels (+5V, +12V & −12V).

CONTROLLER FUNCTIONAL DESCRIPTION

The 1070 Controller is in actuality an 8080 general purpose microcomputer configurated with a Western Digital single chip floppy disk controller port, a controller to host computer parallel memory port, an optional controller to host computer RS232 USART serial memory port, 1K byte static RAM data buffer storage memory, and a 4K byte ROM resident PDOS File Management Firmware memory with all addressing via the memory mapped technique. The host computer port interface includes both a memory data port and command-status port. The command-status port provides the means by which the controller CPU can talk to the host computer and vice versa without conflict because of the coordinated handshake technique utilized. For reference see Figure 2, Model 1070 block diagram and Figure 3, Model 1070 logical diagram.

Host Computer Interface

The 1070 Intelligent Disk Controller provides two methods of interfacing a floppy disk memory system to the microcomputer of your choice. An 8-bit parallel data port interface is standard while an RS232 serial interface is available as an added option. The RS232 interface is used to interface the host computer in those cases where the computer MIB bus structure does not provide a natural logical interface.

One of the major features of the 1070 Controller with its own resident DOS firmware is that it allows the Controller to be interfaced to any mini- or microcomputer such as the 8080, Z-80, 6800, 6502, and others with a minimal effort requiring in some cases only a simple host computer I/O driver software routine to be up and running.

Parallel Interface — The parallel interface is a two port (data and command-status ports) programmed I/O or memory mapped addressed full handshaking co-ordinated bidirectional data transfer computer interface. The command-status port with ASCII communication protocol control characters (**EOT, ACK, NAK, SOH** & **ENO**) co-ordinates data transfers in both directions and provides means of uniquely distinguishing communications control characters from data characters or bytes. The selection between the data port and command-status port is accomplished by the LSB (A_0) address line of the host computer. (A_0 selects the command-status port while A_0 selects the data port). Handshake coordination between the 1070 controller and host computer is accomplished through the command-status port by the four controller status bits shown in the following Figure 4,

STATUS BIT#	STATUS BIT INFORMATION	STATUS BIT CONTROL
0	Computer output control character transferred to controller input register U2	Controller sets up status bits
1	Computer output data character (or byte) transferred to controller input register U2	Computer resets status bits on reading contents of controller output register U1
6	Controller data character in controller output register U1 and ready for transfer to computer	Computer sets up status bits
7	Controller control character in controller ouput register U1 and ready for transfer to computer	Controller resets status bits on reading contents of controller input register U2

Figure 4. Controller Handshaking Status Bits

while Figure 5 defines the handshake coordination between controller and computer for those individuals unfamiliar with handshaking techniques.

The 4-bit status co-ordinated handshake technique provides variable or fixed length, blocked or unblocked random or sequential ASCII text, ASCII HEX object coded or executable binary object coded data to be transferred to and from the floppy diskette storage media.

The parallel port interface includes the following interface signals:

- **8 BIT DATA BUS** (Bus 0-Bus 7)
- **12 BIT ADDRESS BUS** (AD4-AD15)
- **COMMAND/DATA** (Controlled by Address Line A_0)
- **EXTERNAL SELECT**
- **READ**
- **WRITE**
- **RESET COMPLETE**
- **RESET CONTROLLER** (RESET IN)
- **GROUND,** +5 Volts, = 12 Volts & −12 Volts

Typical Parallel Interface — In order to integrate the PerSci controller into your system, using the parallel memory port interface, normally will require three logical IC's and a computer MIB bus to control bus connector adapter. An example of the simplicity of this logical-physical adapter interface is shown in Figure 6.

RS232 Serial Interface Option — An RS232 USART serial interface is provided as an option for interfacing directly to host computers that have a built-in RS232 serial interface. The latest version of PDOS FMF allows both the parallel and serial interface ports to be physically connected but only allows one of the two ports to communicate with the controller at any given time on a first come first served basis. The RS232 serial interface option also includes an on-board USART baud rate selection via a twelve-position DIP rotary switch. The twelve baud rates are as follows:

BAUD RATE	SWITCH SETTING
50	0
75	1
110	2

134.5	3
150	4
300	5
600	6
1200	7
1800	8
2006	9
2400	A
3600	B
4800	C
7200	D
9600	E
19,200	F

The optional RS232 serial interface provides no means either for co-ordinating data transfers through handshaking or for distinguishing between communications control and data characters. Thus, the user must take care not to transmit data to the controller faster than the controller can write it on diskette which depends on the type of operation, type of drive, sector interleave, etc. Furthermore, the user must ensure that the significant communication control character (**SOH, ACK, NAK, ENQ & EOT**) are not embedded in data sent to or from the controller. If binary data file information is to be read or written, the user must provide a suitable escape convention. The RS232 serial interface includes the following interface signals:

- **TxD TRANSMIT DATA**
- **RxD RECEIVE DATA**
- **DTR DATA TERMINAL READY**
- **DSR DATA SET READY**
- **RTS REQUEST TO SEND**

CONTROLLER — COMPUTER COMMUNICATION EXCHANGE	HANDSHAKING SEQUENCE
COMPUTER OUTPUTS COMMAND TO CONTROLLER	1. Computer writes output control character status into the controller's control character input status register U10B (status bit #0) true. 2. Computer writes output control character into the controller's input data, register U2 and sets the controller's data input status register U10A (status bit #1) true. 3. Controller reads input control character and resets the controller's status registers U10A (status bit #1) & U11B (status bit #0) to zero.
COMPUTER OUTPUTS DATA TO CONTROLLER	1. Computer writes output data into the controller's data input register U2 and sets the controller's data input status register U10A (bit #1) true. 2. Controller reads input data from register U2 and resets its status registers U10A (status bit #1) and U110B (status bit #0) to zero.
CONTROLLER OUTPUTS COMMAND TO COMPUTER	1. Controller writes output control character into its output register U1 and sets its control character output status register U9A (status bit #7) true. 2. Computer reads the controller's status bits 6 or 7 as data ready status bits and if either one is true, reads in data from the controller's output register U1, resets controller's status bits #6 & 7 to zero, examines controller's control status bit #7 and sets CPU carry flag to 1 if the control bit 7 is true, otherwise input word is a data word.
CONTROLLER OUTPUTS DATA TO COMPUTER	1. Controller writes output data into the controller's output data register U1 and sets the controller's data output status register U9B (status bit #6) true. 2. Computer reads the controller's status bits 6 or 7 as data ready status bits and if either one is true, reads in data from the controller's output register U1, resets controller's status bits #6 & 7 to zero, examines controller's control status bit #7 and sets CPU carry flag to 1 if the control bit #7 is true, otherwise input word is a data word.
COMPUTER READS CONTROLLER OUTPUT STATUS	1. Computer reads the controller's output status register U9A (status bit #6) and U9B (status bit #7).
COMPUTER READS CONTROLLER OUTPUT COMMAND OR OUTPUT DATA	1. Computer reads the controller's status bits 6 or 7 as data ready status bits and if either one is true, reads in data from the controller's output register U1, resets controller's status bits #6 & 7 to zero, examines controller's control status bit #7 and sets CPU carry flag to 1 if the control bit #7 is true, otherwise input word is a data word.

Figure 5. Handshaking Coordination Exchange

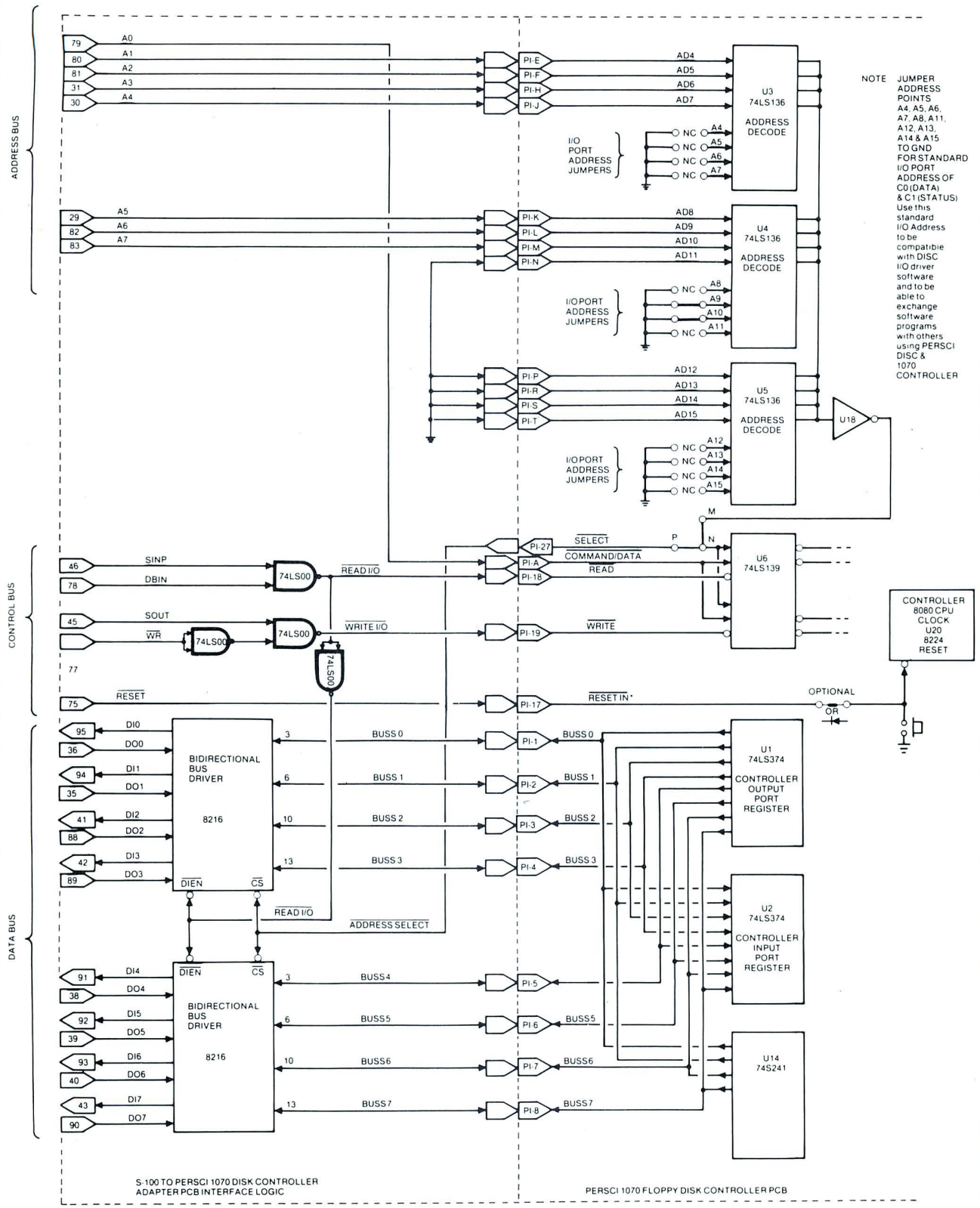


Figure 6. 8080S-100 Bus Controller Interface

- **CTS CLEAR TO SEND**
- **GND GND**

All RS232 interface signals are RS232 voltage levels.

Disk Drive Interface

The floppy diskette drive interface provides the capabilities of controlling four Model 70 single drives or two Model 277 dual drives. The disk drive interface includes the following interface signals:

- **DRIVE SELECT 2-RIGHT** (Drive #3)
- **SEEK COMPLETE**
- **RESTORE**
- **REMOTE EJECT**
- **DRIVE SELECT 2-LEFT** (Drive #2)
- **INDEX**
- **READY**
- **DRIVE SELECT 1-LEFT** (Drive #0)
- **DRIVE SELECT 1-RIGHT** (Drive #1)
- **DIRECTION**
- **STEP**
- **WRITE DATA**
- **WRITE GATE**
- **TRACK 00**
- **WRITE PROTECT**
- **SEPARATE DATA**
- **SEPARATE CLOCK**

CONTROLLER PHYSICAL CONFIGURATION

The Intelligent Controller is mechanized on a single 4.5" x 7" x 0.62" printed circuit board with edge connectors along the 4.5" dimension. Host computer connector interface is via a 72-pin PCB edge connector with .100" conductor center to center spacing while the disk drive connecter interface is via a 50-pin PCB edge connector with 0.100" conductor center to center spacing.

HOST COMPUTER I/O DRIVER PROGRAM

A companion article in this issue provides an 8080/Z-80 PerSci controller I/O driver program while next month's issue of INTERFACE AGE will include a 6800 I/O driver program. Both of these programs provide complete source code, flow diagrams and descriptive documentation to get your diskette system up and running almost without any programming on your part.

PDOS FILE MANAGEMENT FIRMWARE

The 1070 Intelligent Controller software consists of a 4K ROM resident PerSci Disk Operating System (PDOS) File Management Firmware (FMF). The PDOS FMF program resides in ROM starting at memory address 0000H through and including 2FFFH. PDOS includes all functions normally associated with a DOS except for the host computer I/O driver linkage routine which must reside in the host computer's main memory.

Diskette Data Storage Format

The diskette initialization function of the 1070 controller creates a diskette volume that contains 77 tracks with 26 sectors/track and 128 data bytes per sector. The first track is reserved by the controller for use as an index (i.e. a table of contents) for the diskette volume, while the remaining 76 tracks are available for data storage. Tracks are numbered from 00 to 76 (outer to inner) and sectors are numbered from 01 to 26 on each track. Each sector has a header which defines the track and sector number for the soft sectored diskette. Both the sector header and the data itself is written with a 16-bit cyclic redundancy check (CRC) word. Formatted data capacity of each track is 3328 bytes while the capacity of each diskette is 252,928 data bytes, excluding index track. The index track accommodates up to 100 file index references, each consisting of the following index information.

- **NAME** (up to eight alphanumeric characters)
- **VERSION** (up to three alphanumeric characters)
- **TYPE** (single alphanumeric character)
- **START OF FILE ALLOCATION** (4 digit decimal number)
- **LENGTH OF FILE ALLOCATION** (4 digit decimal number)
- **POSITION OF THE FILE EOF MARK** (4 digit decimal number)
- **DATE OF FILE CREATION** (Six digit decimal number)
- **DATA OF LAST UPDATE** (Six digit decimal number)

Table 1. Access Methods Characteristics Summary

ACCESS METHOD	DELIMITER	SMALLEST ELEMENT OF DATA TRANSFERRED TO OR FROM MEMORY SYSTEM	PDOS STORAGE & RETRIEVAL COMMANDS
DIRECT	SECTOR #	SECTOR	INPUT OUTPUT
RELATIVE	# OF BYTES	BYTE	READ WRITE
PUNCTUATED	ASCII RS CONTROL CHARACTER	RECORD	READ WRITE
STREAM	FILE NAME	FILE	LOAD SAVE

Note:
Fixed length is defined as the specified length or number and is part of the PDOS command, whereas the length of a variable-length record or file is determined by delimiters, such as RS control characters or file name and EOF control characters.

File Allocation

When a new file is created on a diskette volume, it receives an allocation of contiguous sectors. The minimum file allocation is one sector, and the maximum is 1976 sectors (i.e. 76 tracks of 26 sectors, or 252,928 bytes). The first file created on a newly initialized diskette receives an allocation starting immediately above the index track. Subsequently created files receive an allocation starting immediately above the allocation of the previously created file. The allocation of each file is recorded in the file header information recorded on the index track.

Whenever a file is deleted, its block of contiguous sectors is de-allocated. This leaves a gap in the sequence of allocated sectors on the diskette volume. PDOS provides a GAP command to compress the allocations on a diskette volume, eliminating the gaps caused by previous file deletions.

File Access Methods

The controller PDOS ROM resident File Management Firmware provides the following four methods for accessing and updating files stored on a diskette:

- **STREAM ACCESS**
- **PUNCTUATED ACCESS**
- **RELATIVE ACCESS**
- **DIRECT ACCESS**

Stream Access — The stream access method permits an entire ASCII text, ASCII HEX object program or binary program file to be stored or retrieved as a continuous stream of data bytes (as if the diskette file were a very high speed paper tape). Stream access is ideally suited for the storage and retrieval of executable binary programs, ready to run BASIC application programs and completed ASCII text word processing files. Stream access is performed on opened or closed files using the **LOAD** and **SAVE** controller commands.

Punctuated Access — The punctuated access method treats a file as a sequence of variable-length records separated by the non-printing ASCII control character **RS**. Prior to file access a file reference pointer is positioned via the **POSITION** command to the desired record position.

Variable-length punctuated file records may then be read or written in continuous sequence, or one at a time by using the **READ** or **WRITE** commands if the file is open. Reocrds may span sector boundaries of a diskette (sector boundaries are made transparent by the controller). Punctuated access is appropriate for the storage and retrieval of ASCII text word processing files, BASIC application programs, assembler source programs and HEX object programs which are to be accessed sequentially, one record or line at a time and are in ASCII text or ASCII HEX format. Because of its dependency upon the unique ASCII RS punctuation control character to separate records, punctuated access can not be used to store and retrieve binary data.

Relative Access — The relative access method treats a file as a byte-addressable random access memory. Prior to file access, a file reference pointer is positioned to any desired byte position. Any fixed length number of bytes may then be stored or retrieved by using the **READ** and **WRITE** commands if the file is open. Relative **READ** and **WRITE** operations may span sector boundaries but this is made transparent by the controller. Relative access is ideal for data base oriented applications in which random byte access is required.

Direct Access — The direct access method permits any specified single sector of any specified track of a diskette volume to be read or written directly by using the **INPUT** and **OUTPUT** commands and thereby bypassing the file management functions of the controller altogether. Files need not be open prior to an **INPUT** or **OUTPUT** operation.

The following Table 1 summarizes the characteristics of the four access methods:

File Reference

A file reference identifies a particular file or group of files. File references may be either unique or ambiguous. A unique file reference identifies one file uniquely, while an ambiguous file reference may be satisfied by several different files. File references consist of four identifier fields:

REQUIRED FILE STATUS TO STORE OR RETRIEVE FILE DATA	FILE LENGTH CLASSIFICATION	FILE ACCESS		CLASS OF FILE HANDLED VERSUS COMPUTER I/O PORT INTERFACE			
		RANDOM	SEQUENTIAL	PARALLEL		SERIAL	
				BINARY	ASCII	BINARY	ASCII
OPEN OR CLOSED	FIXED	X	X	X	X		X
OPEN	FIXED	X	X	X	X		X
OPEN	VARIABLE		X		X		X
OPEN OR CLOSED	VARIABLE		X	X	X		X

- **N** Name of up to eight alphanumeric characters
- **V** Version of up to three alphanumeric characters
- **T** Type specified by a single alphanumeric character
- **D** Drive which is a numeric digit between 0 and 3.

The version, type and drive identifier fields are optional and are set off from the name by means of the unique leading punctuation characters (period, colon, and slash) as shown in the following

NNNNNNNN.VVV:T/D

The period punctuation character denotes start of the version identifier field, colon denotes start of type identifier field, while slash denotes start of the drive identifier field.

The following are examples of the valid file references:

MONITOR	FILE NAMED MONITOR
MONITOR.SRC	FILE NAMED MONITOR, VERSION SRC
MONITOR.OBJ:A	FILE NAMED MONITOR VERSION OBJ, TYPE A
MASTER/2	FILE NAMED MASTER, DRIVE 2
MASTER:$	FILE NAMED MASTER, TYPE $
MASTER.ONE	FILE NAMES MASTER VERSION ONE
STARTREK.BAS/1	FILE NAMED STARTREK VERSION BAS DRIVE 1
STARTREK.X0T	FILE NAMED STARTREK, VERSION X0T
STARTREK:0/3	FILE NAMED STARTREK, TYPE 0, DRIVE 3

The special characters "**?**" and "*****" may be used a file reference ambiguous so that it may match a number of different file. The "**?**" is used as a "wild-card" character which matches any character in the corresponding position in a file reference. Thus the ambiguous file reference:

PER ????.BA?

matches all of the following unambiguous file references:

PERFECT.BAL
PERSCI.BAS
PERQ.BAX

The character "*****" is used to denote that all characters positions to the right are wild-cards. The following examples illustrate the flexibility which this facility provides:

MONITOR.*	=	**MONITOR.???:?**	Matches all files with name "MONITOR"
***.BAS**	=	**????????.BAS:?**	Matches all files with version "BAS"
Z*	=	**Z???????.???:?**	Matches all files starting with "Z"
*****	=	**????????.???:?**	Matches all files on the diskette

Controller Commands

PDOS FMF commands consist of a single alpha character command identifier followed by one or more command parameters. Parameters must not contain embedded spaces, must be set off from one another by spaces and may optionally be set off from the common letter by spaces. All PDOS commands are initiated by a **CR LF EOT** following the command. PDOS mode of operation is directed by one of 17 commands as summarized in the following:

COMMAND	NAME	COMMAND FUNCTION
• A	ALLOCATE	Allocates an empty file & assigns name
• C	COPY	Copy file or diskette
• D	DELETE	Deletes file or diskette
• E	EJECT	Ejects diskette
• F	FILE	Opens & closes file
• G	GAP	Eliminate deleted files & compress diskette storage
• I	INPUT	Read single sector
• K	KILL	Deletes all diskette files
• L	LOAD	Read entire file
• M	MODE	Set default diskette and date
• N	NAME	Rename file
• O	OUTPUT	Writes single sector
• P	POSITION	Sets open file reference pointer position
• Q	QUERY	List diskette index track
• R	READ	Reads specified number of bytes from open file
• S	SAVE	Creates new file and saves input stream data in it
• T	TEST	Executes one of three resident disk drive diagnostic tests

PDOS FMF Command Description

Each of the 17 PDOS FMF commands are described in detail in the following:

COMMAND	COMMAND NAME	FILE ACCESS METHOD	
A	ALLOCATE	—	Allocates an empty file of N sectors long and assigns a file name. File names may consist of up to eight alphanumeric characters. File references may be either unique or ambiguous.
C	COPY	—	Copies file, collection of files, or complete diskette volume to same or different diskette volume. Requires that all files be closed.
D	DELETE	—	Deletes specified file, collection of files, or complete diskette volume.
E	EJECT	—	Ejects diskette in specified drive (effective only if the diskette drive is equipped with remote eject option).
F	FILE	—	Opens and closes diskette files in drive unit 0-3. A file must be open before punctuated or relative access is permitted by the controller. All open files are equated to logical unit numbers between 1 and 5 to reduce number of alphanumeric characters required to define a file name. A maximum of five files may be open simultaneously.
G	GAP	—	Reallocates and compresses diskette storage to eliminate prior file deletions. Requires that all files be closed.
I	INPUT	DIRECT	Reads single sector of specified tract, sector and drive.
K	KILL	—	Deletes all files on specified diskette without initializing diskette or deletes all files and initializes diskette to any one of 13 sector interleave sequences.
L	LOAD	STREAM	Read entire diskette file.
M	MODE	—	Loads current date and sets defule diskette driver number (0-3) for all subsequent file references and commands which do not include an explicitly specified drive.
N	NAME	—	Change specified file name to new name.

O	OUTPUT	DIRECT	Writes a single sector into an open file of specified drive.
Q	QUERY	—	Reads index track header information from one, group, or all files on specified diskette volume. This header information includes the following file record data: •File name version & type •Start of allocation (decimal track and sector starting address). •Length of allocation (decimal number of sectors). •Position of the end-of-data mark (decimal sector and byte offset). •Date of creation. •Date of last update.
R	READ	RELATIVE OR PUNCTUATED	Reads specified number of bytes from open file of specified drive (fixed-length or variable-length records). Variable-length records delimited by a record separator character **RS**.
S	SAVE	STREAM	Creates a new variable-length file record in specified diskette. File sector allocation size is determined by length of the data stream record.
T	TEST	—	Executes one of three resident diagnostic tests on specified drive. The three diagnostic tests are random seek-verify test, random seek-read test, and incremental seek-read test.
W	WRITE	RELATIVE OR PUNCTUATED	Writes a fixed-length or variable-length record into an open file on specified or default selected drive.

Protocol Software Handshaking Interface

The PDOS Command protocol interface between the host computer and the controller is accomplished by utilizing the standard ASCII communications control characters **SOH, ACK, NAK, ENQ** and **EOT** as controller-host computer communication commands. These protocol communication commands are used under a co-ordinated handshaking technique to control all data communication between the controller and host computer via the controller command-status port. Normally the computer issues a PDOS comand followed by a communication command sequence (**CR LF EDT**), whereupon the controller transmits data or answers back by issuing a single or sequence of communication commands, data or error message if appropriate followed by the terminating communication command sequences **ACK EOT.** This co-ordinated handshake protocol interface command sequence is shown in the following Figure 7, for each PDOS command.

Error Diagnostic Messages

The controller issues fatal and non-fatal error diagnostic messages. Fatal error diagnostic messages transmitted by the controller are always proceeded by a NAK control character and followed by an EOT control character. These error diagnostic messages indicate the premature and unsuccessful termination of a controller command.

Fatal Errors — Fatal error diagnostic messages are as follows:

- **COMMAND ERROR** Indicates an invalid command or command parameter.
- **DUPLICATE FILE ERROR** Indicates an attempt to create a new file with the same name as an existing file on the same diskette.
- **NOT FOUND ERROR** Indicates that a file with the specified name could not be found in the index of the specified diskette.
- **OUT OF SPACE ERROR** Indicates an attempt was made to exceed the capacity of a diskette or exceeded the index track capacity.
- **READY ERROR** Indicates an attempt was made to access a diskette drive which is not ready.
- **UNIT ERROR** Indicates an attempt was made to read, write, or position a logical unit number that is not equated with an open file.
- **HARD DISK ERROR** Indicates a seek, read, or write error which could not be successfully resolved in five retries.

Note that each fatal error message begins with a unique alpha character, so that an interfacing program need only to analyze the first character following a NAK control character to determine the type of fatal error.

Non-Fatal Errors — Non-Fatal error diagnostic messages are issued for soft disc errors. They are not preceded by a NAK control character, and they contain the following information:

- **TYPE OF DISK OPERATION** (seek, read or write)
- **ERROR RETRY NUMBER** (1 to 5)
- **DISKETTE LOCATION AT WHICH ERROR OCCURRED** (decimal track and sector)
- **TYPE OF ERROR** (protect, write fault, verify, CRC, or lost data)

During the transmission of diskette data (**LOAD, SAVE, READ, WRITE, INPUT** and **OUTPUT** commands), non-fatal error messages are suppressed.

PDOS COMMAND	COORDINATED HANDSHAKE PROTOCOL SEQUENCE
ALLOCATE	COMPUTER TRANSMITS: **PDOS COMMAND CR LF EOT**
EJECT	
FILE	CONTROLLER TRANSMITS: **ACK EOT**
KILL	
MODE NAME	
TEST	
COPY	
DELETE	COMPUTER TRANSMITS: **PDOS COMMAND CR LF EOT**
GAP	
POSITION	CONTROLLER TRANSMITS: **INFORMATION-DATA CR LF ACK EOT**
QUERY	
INPUT	
LOAD	COMPUTER TRANSMITS: **PDOS COMMAND CR LF EOT**
READ	CONTROLLER TRANSMITS: **SOH DISK-DATA ACK EOT**
OUTPUT	COMPUTER TRANSMITS: **PDOS COMMAND CR LF EOT**
SAVE	
WRITE	CONTROLLER TRANSMITS: **ENQ EOT** COMPUTER TRANSMITS: **DISK-DATA EOT** CONTROLLER TRANSMITS: **ACK EOT**
Note: Controller may terminate command at any time with fatal error diagnostic message by using the following protocol	CONTROLLER TRANSMITS: **NAK** FATAL-ERROR MESSAGE **CR LF EOT** Note: No **ACK** will be transmitted by the controller in this case.

NEW PRODUCTS

Hardware Bootstrap for Popular Diskette System

Data Systems Design recently announced a hardware bootstrap for their popular DSD 210 DEC compatible floppy disc system.

The new bootstrap capability allows a PDP-11 or LSI-11 user to load RT-11 from the diskette unit with a single command. The bootstrap instruction sequence is contained on a PROM which is a part of the DSD 210 interface. This new feature saves the cost and backplane slot of the REV-11 board for LSI-11 users and it can reduce start-up time on the PDP-11.

Data Systems is the originator of the "DEC compatible" diskette system. The DSD 210 requires no special software drivers to operate under RT-11, RSX-11, or OS/8 operating systems. The controller, power supplies, and up to three diskette drives are packaged as a complete unit which can be used with LSI-11, PDP-11, or PDP-8 minicomputers simply by changing interfaces. The DSD 210 uses a microprocessor controller-formatter and includes extensive self-test diagnostics. It also uses the popular Shugart SA 800 diskette drives.

The DSD 210 including the new bootstrap feature is available 30 days after receipt of order. Quantity one price is $1000 less than the DEC offering. Bootstrap feature is included at no additional charge.

For further information, contact Data Systems Design, Inc., 3130 Coronado Drive, Santa Clara, CA 95051, (408) 249-9353.

CIRCLE INQUIRY NO. 109

Plug S-100 Boards into KIM?

The KIMSI™ makes S-100 (Altair/IMSAI) type boards *plug compatible* with KIM. The Kimsi board attaches to any KIM-1 computer and on a single board provides both the interface logic *and* a fully buffered motherboard with eight 100-pin slots.

The ability to use currently available S-100 memory, video, I/O, PROM programming, graphics, and music and speech synthesis boards, etc., makes Kimsi an excellent base for a complete KIM system for any application. With the low cost of S-100 memory, Kimsi will "pay for itself" even for a simple memory expansion.

In use, Kimsi does not alter the operation of KIM in any way. Instructions are executed at full speed and no extra instructions or software tricks are needed. The board includes complete address decoding and power regulation for KIM, and even facilities for DMA an multiprocessing on the S-100 bus.

The Kimsi kit comes with a high-quality double-sided circuit board with soldermask and their "you don't have to be an engineer to understand it" Assembly/Operating Manual to back up their claim of easy assembly. The $125 price includes all parts, sockets for the ICs, and one 100-pin connector. The assembled version, which includes the 100-pin connector soldered in place, is available for $165 and is warranteed for six months. For further information contact: Forethought Products, P.O. Box 586, Coburg, OR 97401, (503) 485-8575.

CIRCLE INQUIRY NO. 110

System 8813

The System 8813 is a compact complete disc-based microcomputer. The central unit, no larger than a stereo component, includes 16K bytes of RAM and room for three mini-floppy disc drives, in a walnut case with a brushed aluminum front panel. Included in the package is a video monitor, keyboard with cable, and complete system software on a diskette.

System software allows you to put the system to work immediately, running applications in either assembly language or in fully extended BASIC. The small separate keyboard permits convenient use of the system at desk or table. The high speed video display exhibits your results in graphics and alphanumerics. Because it uses mini-floppy discs, the 8813 allows convenient storage and fast access to programs and data by means of simple user commands. For the first time, interactive computing applications are feasible in a small system.

Prices start at $3250. For details on the system and applications library, write PolyMorphic Systems, 460 Ward Drive, Santa Barbara, CA 93111; (805) 967-0468.

How to Hand Crimp

Molex Incorporated has made available a two page flyer on how to hand crimp properly standard terminals to 14-26 size wire. This informative flyer will help every production manager and engineer who frequently runs into this problem. For more information contact Molex Inc., 222 Wellington Ct., Lisle, IL 60532.

CIRCLE INQUIRY NO. 111

INFORMATION SERVICE

National CSS is the nation's largest independent supplier of on-line computer services. The company specializes in the computer-based translation of raw data into useful business information.

Since its incorporation in 1967, National CSS has become a leader in the information services industry by supplying solutions to specific business problems through the application of an effective mix of computers, communications, software and personal service. Their software operates on one of the largest on-line computer centers in the world, accessible through 60,000 miles of leased data communications lines and serviced by branch offices in 28 locations throughout the United States, England and France.

Today, this system is being used by over 2,000 customers who are currently doing over $45,000,000 worth of business a year.

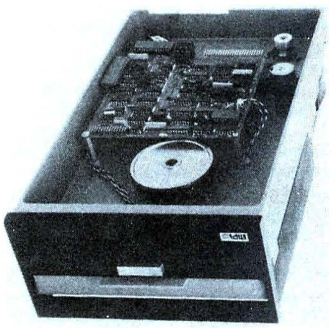
During the last year, National CSS has made a major commitment to the needs of financial managers. Recent additions to their services for financial managers include: a Financial Reporting capability which includes the Value Line and Telstat data bases, an upgrade of their Basic Accounting Service so it can interface directly with intelligent terminals, and an entire upgrade of their ECONOMIC MODELING SYSTEM with its interface with Merrill Lynch Economics, Inc. financial models and data bases. These new services complement their existing services of over 50 products in the areas of financial planning, data base management, scientific and engineering research, and computer languages.

For further information contact National CSS, 542 Westport Avenue, Norwalk, Connecticut 06851.

CIRCLE INQUIRY NO. 112

Band-driven Flexible Disc Drive

This drive is a design concept similar to IBM, and can fit virtually any mini- or micro-computer application and uses standard 8-inch diskettes. Applicable areas range from point-of-sale, word processing, data entry, data collection, and data storage for small business systems to a growing use of this medium in many industrial applications.



Called the Series B82, MPI's random access drive offers up to 6.4 megabits per disc for a single density drive and up to 12.8 megabits per disc for a double density drive. It can store up to 1.6 megabytes on an industry standard 8-inch diskette. The B82 drives use MFM, M²FM and GCR encoding techniques.

The B82, like all MPI drives, offers both hard or soft sector format operation. It will read or write any IBM-compatible diskette having the appropriate format. The B82 is compatible with the IBM 3740, S/32, 4964 (two sided), and 3600. It is also compatible with the SA 850/851.

Also unique is the automatic diskette position and ejection feature. This allows the operator to just push in the diskette and close the door for automatic positioning. A simple button is pushed for automatic ejection.

The MPI drives are designed to use standard 8-inch IBM compatible diskettes manufactured from a great variety of manufacturers. These low cost, oxide-coated mylar diskettes are durable and easily stored. Projected media life is 3.5 x 10^8 passes per track.

For further information contact Micro Peripherals Inc., 8724 Woodley, Sepulveda, CA 91343. (213) 894-4076.

CIRCLE INQUIRY NO. 113

Model MCS-PT Processor Terminal

Designated the Model MCS-PT, this new processor terminal is a complete and self-contained computer system with display and disc storage, a full keyboard and a 12-slot motherboard. It may be used either as a stand-alone processor or as a processor terminal in a larger system.

Features of the processor terminal include a 15" high-resolution monitor with a face plate of smokey plexiglass to reduce glare and improve type visibility; a full upper and lower case ASCII keyboard with eight user designated special function keys and a 16-key numeric cluster pad. One Shugart SA-400 mini-floppy disc drive is standard.

The 12-slot mainframe contains a CPU board that features an 8080 processor and a special circuit that implements a start up "jump to" routine to any user selected byte address. Turn power on or press the reset switch and the system boots to your preselected location. 16K RAM of memory is provided with additional RAM as an optional item. A disc controller which will handle four drive sand a video board are also standard items. The I/O board provides three parallel and three serial port with selectable baud rates of 75 to 19,200. Outputs are RS-232C or TTL.

The whole unit is housed in a heavy duty aluminum cabinet with power provided by a constant voltage transformer (CVT) power supply that makes brownouts a thing of the past. A fan, washable filter and all edge connectors and card guides are furnished. Software provided includes CP/M DOS and BASIC on disc. The MCS-PT fully assembled and tested is priced at $3495.00, and in kit form is priced at $2995.00.

The unit is also available without the disc drive and controller at $2495.00 assembled or $2195.00 in kit form.

For more information, contact CMC Marketing Corp., 7231 Fondren Road, Houston, TX 77036 or call (713) 774-9526.

CIRCLE INQUIRY NO. 114

North Star Executive Software

XEK, a complete system executive package for North Star users, is now available from the Byte Shop of Westminster.

The XEK package contains a disassembler capable of creating files that may be left in memory when changing from the disassembler

to the executive package for re-assembly. The monitor software has the ability to accept input from cassette tapes and paper tape as either source or object files, as well as from the North Star diskette system. In addition, the assembler features a new auto-line editor for the creation of source files. This editor also extends to the modification of existing object files.

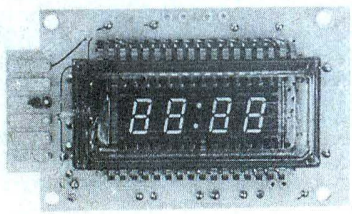
Another feature is the XEK's ability to handle up to six named files at once that may be consecutively assembled to form one object file. The assembler, monitor, and disassembler come with complete documentation, both on disc and as a manual. Total price, including first class postage, insurance and California resident's sales tax, is $48.00.

For further information and ordering, contact: The Byte Shop of Westminster, 14300 Beach Blvd., Westminster, CA 92683, (714) 894-9131.

CIRCLE INQUIRY NO. 115

Digital Clock Modules for Cars or Boats

The MA1003 digital clock module features a four-digit, 0.3" green vacuum fluorescent display with a blinking colon activity indicator. Accuracy is said to be ± 0.5 seconds per day.



Automatic display control circuitry turns off the display with ignition off, reduces brightness to 33% with park or headlights on and follows the dash lamp dimmer control setting. A lens may be used to filter the display color to blue, blue-green, green or yellow.

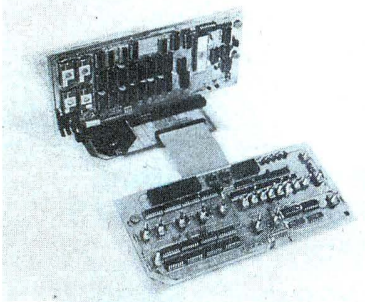
The digital clock module is ready-to-use with the addition of three switches to control the "hours set," "minutes set" and "display on" functions. The "display on" switch is used to display the time when the ignition is off.

The MA1003 Digital Clock Module for 12 VDC vehicle or portable applications is priced at $24.95. For further information contact Radio Shack, 2617 W. 7th St., Fort Worth, TX 76107, (817) 390-3272.

CIRCLE INQUIRY NO. 116

Microputer 6000

The Microputer 6000 is an introductory microcomputer system designed for the microstudent as a low cost way to learn microcomputers with an easy-to-use hardware control panel. It is a complete, powerful microcomputer system for the hobbyist and the professional. It can be quickly and conveniently expanded to fulfill the most demanding microcomputer application. All 6000 series circuit boards are standard S100 computer bus compatible.



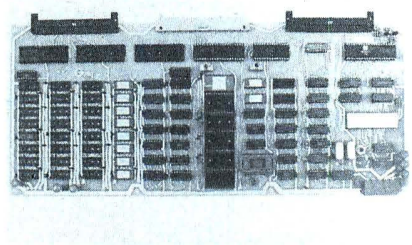
The Level II MPU Board and the Motherboard use the standard S-100 computer bus structure. The microcomputer can be expanded to virtually any level with modules available to generate color graphics and text on a television set, to read and store programs through any audio recorder, and to connect keyboards, printers and a variety of special input/output cards.

A complete cabinet with power supply is available for the Microputer 6000. The heavy duty power supply provides: +8 Volts @ 10 Amps, +16 Volts @ 1 Amp, −16 Volts @ 1 Amp. A rugged and clean looking cabinet to complete the finished microcomputer system. For further information, contact CGRS Microtech, P.O. Box 368, Southampton, PA 18966, (215) 757-0284.

CIRCLE INQUIRY NO. 117

90 MPS — OEM Microcomputer System

The Quay 90 MPS is a single board Z-80 based microcomputer System for OEM systems and development. The basic board includes 6K bytes of memory, (4K bytes of dynamic RAM, 1K byte of static scratch pad RAM, and 1K byte Monitor in 2708 UVPROM), two Z-80 parallel I/O chips which provide 4 parallel I/O ports, a UART with RS-232C and 20 ma. current loop interfaces, 2.5 MHz crystal clock, a Z-80 counter timer, and a PROM programmer for 2708 type UCPROMS. The system is constructed on a .093", two sided P.C. board and measures 16.175" x 6.875". All I/O is via three 60 pin flat ribbon connectors, eliminating the need for motherboard and card cage assemblies.



The Quay 90 MPS provides on board expansion to meet the needs of virtually any system. The dynamic RAM memory can be expanded to 16K bytes, using 4K x 1 devices or to 65K bytes using 16K x 1 devices, and a total of 7K bytes of 2708 UVPROM can be installed on the board. Sockets are also provided to permit the addition of two more Z-80 PIO chips. All of the Z-80 address and output control lines are fully buffered, input control lines are pulled up, and the bi-directional data bus is tri-state buffered. All lines are available at the I/O connectors to permit ease of interfacing, including the use of Z-80 vectored interrupts and DMA operations. An option for 4 MHz operation is also available.

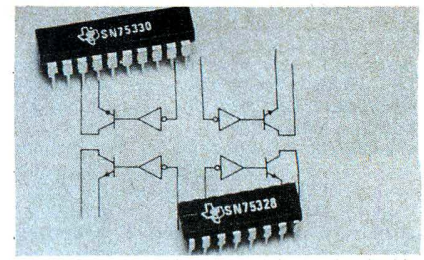
The 2708 UVPROM Monitor is set up to start the system on reset, and provides a powerful set of debug instructions including multiple breakpoints, single step, trace, alter, dump, copy, load, and program PROMs.

The basic Quay 90 MPS is priced at $695.00 in (Qty. 1) and $500.00 in OEM quantities (Qty. 100). Delivery is 4 weeks ARO. For further information, contact Quay Corporation, P.O. Box 386, Freehold, NJ 07728, (201) 681-8700.

CIRCLE INQUIRY NO. 118

Quadruple Memory Driver ICs for Use with Core and Bubble Memories

The SN75328 and SN75330 each contain four 600-milliampere memory drivers and operate from two power supplies — one of five volts (Vcc1), the other from 4.75 to 24 volts (Vcc2). The driver ICs can function individually as either source or sink since the voltages at the output transistors terminals are capable of swinging between Vcc2 and ground.



The SN75328 driver comes in 16-pin, dual-in-line plastic or ceramic packages. The base drive of all four of its output transistors is provided by connecting an external resistor of the appropriate value between Vcc2 and Node R.

The SN75330 driver comes in 20-pin, dual-in-line plastic package. The base drive of each individual output transistor of these devices is provided by connecting an external resistor of the appropriate value between Vcc2 and the corresponding Node R.

Both devices are characterized to operate from 0° to 70°C.

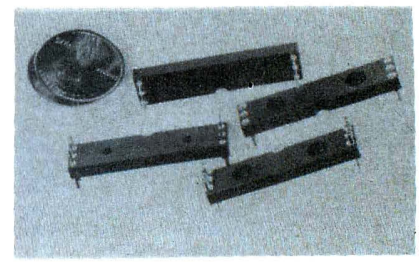
Prices for each part in quantities of 100 or more are: SN75328, $2.47, plastic; $3.20 ceramic; SN75330, $3.20 plastic.

For further information contact Texas Instruments Incorporated, Inquiry Answering Service, P.O. Box 5012, M.S 308 (Attn: SN75328, SN75330), Dallas, TX 75222.

CIRCLE INQUIRY NO. 119

Ultra-Low Relay and Module Sockets

Called "Series 130," these new sockets are low-profile, thermoplastic-body Valox 420 SEO, UL 94VO-listed material with 1.300-inch center. The contacts are four-tine, berylium-copper springs, gold-plated for high conductivity.



They have brass sleeves, either gold-plated or electroplated tin, with dip-solder terminals or solderless wire-wrap .025-square-inch terminations.

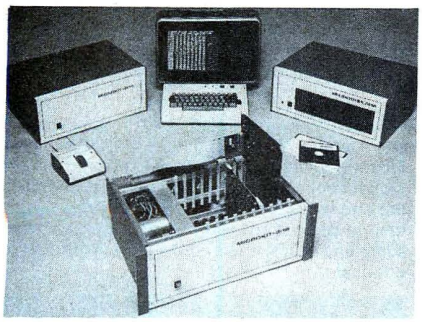
The Series 130 headers can be supplied with eight to 40 contacts and accept .016- to .020-inch diameter flat or round component leads; they mate with headers having 1.300-inch centers. They are also available with turret or slotted-type terminals for component mounting and can be supplied with a variety of pin configurations from Garry's standard family of electrical contacts.

Series 130 sockets are available in 2 to 4 weeks, at prices ranging from $.50 to $2.50. For further information, contact: Garry Manufacturing Co., 1010 Jersey Ave., New Brunswick, N.J. 08902, (201) 545-2424.

CIRCLE INQUIRY NO. 120

The Microemulator™

The Microemulator extends the editing, assembling and debugging capabilities of Microkit's 8080/6800/Z-80 Product Development Systems directly into a prototype or production system. The Microemulator probe plugs directly into a prototype's CPU socket and allows debugging of the prototype in its own environment. Programs residing in the microcomputer's RAM memory can execute and access the memory and I/O devices, emulating actual usage. In addition to basic monitor commands, provision is made for enabling emulation mode, single step and trace execution, hardware breakpoints and 2708/2704 EPROM programming.



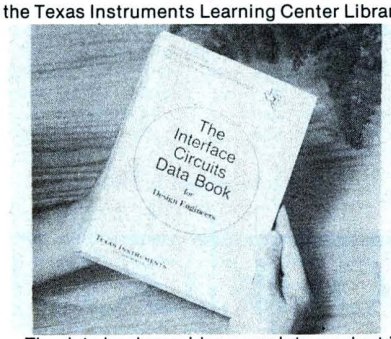
Applications include hardware/software development and integration, production test and depot maintenance of microprocessor systems. Microemulators are offered for 8080, 6800 or Z-80 microprocessors and are compatible with any of Microkit's tape-based or disc-based systems, including high-speed QUICK-RUN "in-memory" operating systems which provide the only co-resident assembly and interactive debugging system in the industry.

The complete system package consisting of an M8-40 Microemulator and M8-41 Debug and EPROM programmer is priced at $1250.00. Availability is from stock. Manufacturer: MICROKIT, INC., 11205 So. La Cienega Blvd., Los Angeles, CA 90045, (213) 641-7700.

CIRCLE INQUIRY NO. 121

The Interface Circuits Data Book

A new 576-page linear IC catalog, "The Interface Circuits Data Book," is offered at $4.75 by the Texas Instruments Learning Center Library.



The data book provides complete product information on line drivers, receivers and transceivers, memory drivers, MOS interface drivers, sense amplifiers and peripheral drivers, also covered are display drivers for LED, AC plasma, gas discharge and thermal print displays.

Included are selection and interchangeability guides and complete thermal information on all applicable package types. Margin tabs and alphanumeric indexes provide easy reference.

Make checks and money orders to Texas Instruments Incorporated and send to: P.O. Box 3640, MS 54M, Dallas, TX 75285. Postage paid. Add state and local taxes where applicable.

CIRCLE INQUIRY NO. 122

OCR-A Scanner for Department Store Applications

A hand-held scanner which automatically reads prices and other information on merchandise tags in department stores has been released for sale by NCR Corporation.

The NCR 7867, a pistol-shaped device weighing only 6 ounces, is moved by the salesperson over the merchandise tag. The information is printed in an Optical Character Recognition (OCR) type font which can be read by people as well as machines.

The scanner reads the data, edits it and transmits it to the NCR retail terminal to which it is attached. The scanner is an option available immediately with the NCR 280 and 250 systems. It will be released for the NCR 255 and 2151 systems in the future.

The OCR-A type font read by the scanner has been adopted by the National Retail Merchants Association as the standard U.S. marking system for use by general merchandise retailers and their suppliers. OCR-A is also widely used by overseas retailers.

The readers can be used for taking inventory and for receiving and marking goods. They can also be used to read information on credit cards, employee badges, invoices and other documents.

The scanners can be an integral part of total retail systems which track merchandise electronically from the time it is ordered through the entire retailing cycle.

The new scanning system includes a small electronics unit which is linked to either a 280 retail terminal or a 250 freestanding electronic cash register. The electronics unit checks for invalid characters before transmitting the data to the terminal.

A department store can specify the type of format used on its merchandise tags by filling out a specification sheet. Each 7867 unit is then delivered with a programmable Read Only Memory chip which incorporates those specifications. Formats can be changed by plugging in a new memory chip.

The scanner, priced at $1,500 is available in both U.S. and international versions. For further information, contact NCR Corporation, Dayton, Ohio 45479, (513) 449-2150.

CIRCLE INQUIRY NO. 123

D400 Polling Terminal

Designed for the demanding performance of a large system environment, the D400 Full-Feature POLLING terminal squarely addresses data entry and interactive system applications where a SMART terminal makes sense. With smarts like editing, protected format, function keys, program mode, an extensive set of screen attributes and remote function commands, the D400 is as easy to operate as it is to interface your system software to.

Communication firmware provides full Burroughs polling protocol compatibility, with a group poll and group select option available. Other polling protocols are also available for your multidrop network requirements. A standard auxiliary port connector is available for multi-terminal applications using the economics of daisy-chaining for efficient communications.

System integration ease is enhanced by features such as detachable Keyboard, with all functions under CPU or KB control. The screen indicators show at a glance what operating modes are active, further reducing the chance of operator error.

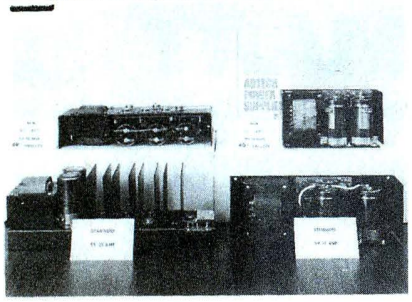
For hard copy requirements, a local printer may be attached to an optional printer port. Complete flexibility for asynchronous character parameters and baud rate are switch selectable features of this RS-232C interface. A Keyboard PRINT key activates the printer and initiates transmission of the display contents to the printer.

For further information, contact EECO, 1441 E. Chestnus Ave., Santa Ana, CA 92701, (714) 835-6000.

CIRCLE INQUIRY NO. 124

"Energy Miser"

These units, designated the "ENERGY MISER" EMPS SERIES improve efficiency by 30 to 40% permitting size reductions of 30 to 45% in low voltage power supplies.



This "Energy Miser" Series provides a 5 Volt 40 Amp supply in the same package volume as conventional 5 Volt 25 Amp units. A 5 Volt 25 Amp unit in a slightly smaller package than former 5 Volt 18 Amp units and a 5 Volt 18 Amp unit in the same package as present 5 Volt 12 Amp units. With microprocessor and LSI chips permitting higher packaging densities and therefore needing higher power requirements in a given package size, the "Energy Miser" Series provides an economical means of providing this extra power without increasing package size and cooling.

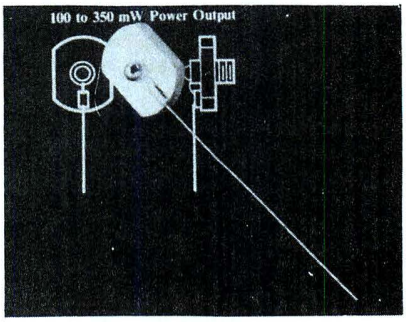
Sixteen models are available in singles, duals, and triple outputs, ranging in price from $82 to $210 for a 5 Volt 40 Amp unit. Prototype units are now available with full production quantities available in October.

For further information, contact Adtech Power, Inc., 1621 S. Sinclair St., Anaheim, CA 92806, (714) 634-9211.

CIRCLE INQUIRY NO. 125

GaAs IRED's

A new series of three P-N gallium arsenide infrared-emitting diodes (IREDs) feature high power outputs ranging from 100 to 350 milliwatts (mW) at 25°C. Each diode in the TIES 16 Series has a gallium-arsenide dome for greater efficiency.



At two ampere forward bias, typical power output (Po) for the TIES 16A is 150 mW and 230 mW for the TIES 16B. Typical power output for the TIES 16C is 350 mW at three amperes forward current.

Other parameters include: typical 0.93 micrometer (μm) wavelength at peak emission (λp); 450 angstrom spectral bandwidth ($\Delta\lambda$) and a 150° half-intensity beam angle. Static forward voltage (V_F) is 1.6 volts for the "A" and "B" diodes, and 1.8 volts for the "C" version. Typical rise times are 300 n sec for each of the three IRED's.

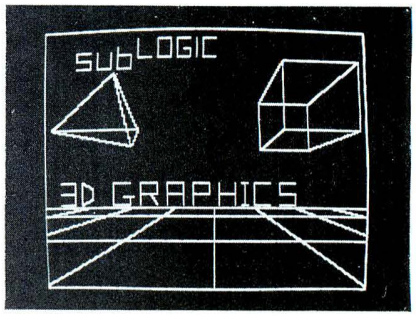
These diodes are mounted on copper stud headers to provide efficient heat sinking. The anodes are in electrical contact with the copper studs. The cathode leads are varnished 0.01-inch copper wires secured to the studs by metalized ceramic insulators.

TIES 16 Series diodes are available from TI Dallas four weeks after receipt of order. In 100-piece quantities, the TIES 16A is priced at $32.50; the TIES 16B at $99.00 and the TIES 16C at $184.00. For further information, contact Texas Instruments, Incorporated, P.O. Box 5012, M/S 308 (Attn: TIES 16), Dallas, TX 75222.

CIRCLE INQUIRY NO. 126

Three Dimensional Microcomputer Graphics

The Sublogic 3D micrographics package will allow a microcomputer user to view two dimensional perspective projections of three dimensional scenes from any location in space. Driving and flying simulations, artistic projections, design projections, engineering analysis, and advanced games are now simple and economical.



Two versions of the graphics package will be offered. A minimal subset Basic version will be ideal for general purpose, slow speed graphics on any microcomputer system. The 6800 optimized assembly language version with dynamic graphic capabilities is ideal for advanced simulation and complex graphics.

Simple adaptation instructions, program listings, applications, interface, and testing information will be supplied with each package.

The Basic version will retail for $22. The 6800 package will be priced slightly higher. Dealer inquiries are welcome. For further information contact Sublogic, P.O. Box 3442, Culver City, CA 90230.

CIRCLE INQUIRY NO. 127

CIRCLE INQUIRY NO. 100

Ultra-Thin, Telescoping Test Probes

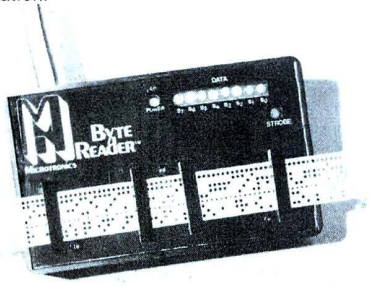
An ultra-thin, telescoping test probe developed specifically for the expanding world of micro-circuitry and miniaturized components is now available from Huntron Instruments, Inc. A two and three-quarter inch, extendable electrode of tempered steel is coated to its needle-sharp tip with material delivering 1 KV insulation. A patented locking feature fixes the extension positively at the desired working length and will not compromise the protective insulation. A fire-retardant Valox barrel houses the extendable probe.

Fits all manner of bench and portably test instruments and comes with five feet of 18 gauge, PVC-coated Superflex leads. Supplied with standard banana plugs. For further information contact Huntron Instruments, inc., 15123 Pacific Highway (#99) North, Lynnwood, WA 98036.

CIRCLE INQUIRY NO. 128

Byte Reader™

The BYTE READER™ is an inexpensive, yet versatile, optical paper tape reader designed to fill the needs of the computer hobbyist. Unlike similar products, the BYTE READER™ features a LITE OPTIMIZER™ circuit which senses the intensity of the external light source and automatically adjusts the sensitivity level of the photo transistors for proper operation.

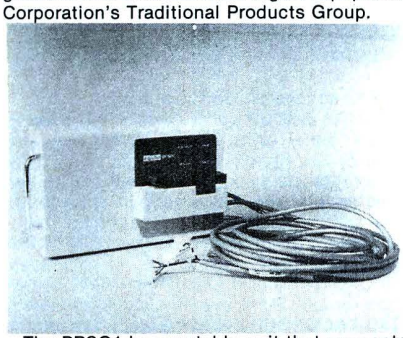


The BYTE READER™ features LED data bit indicators which enable you to visually verify data being sent to the computer. Topping off these features is an acrylic front panel with photo mask backing which gives the BYTE READER™ a professional look. The kit sells for $69.95 or fully assembled for $84.50. Include $3 shipping and handling and 6% CA tax if applicable. For more information write to MICROTRONICS, P.O. Box 7454N, Menlo Park, CA 94025. Dealer inquiries invited.

CIRCLE INQUIRY NO. 129

PRSO1 Paper Tape Reader

A low-cost serial paper tape reader for loading computer maintenance and other programs is now available from Digital Equipment Corporation's Traditional Products Group.



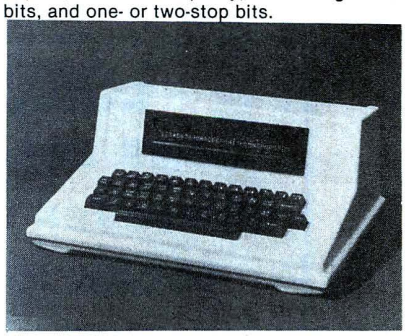
The PRSO1 is a portable unit that connects to the serial line of a computer system console or terminal, or to any 20 mA current loop unit. Offered in versions with either 300-baud or 2400-baud transfer rates, the device reads eight-level tapes and contains its own power supply. Two controls, an on-off switch and a selection switch for either reader or console unit, permit easy operation. The reader is designed for systems or terminals lacking paper tape input capability and for diagnostic testing of dedicated systems. The PRSO1 is priced at $750 and is available for current delivery.

For further information, contact Digital Equipment Corporation, Maynard, Mass. 01754.

CIRCLE INQUIRY NO. 130

Space Saving Terminal

The Transactor I Data Terminal is a small, low cost, highly reliable alphanumeric display terminal designed as an alternative to a CRT and consists of a single line 32-character gas discharge display with a 5 x 7 dot matrix for easy reading, and a 53 key TTY Style keyboard. It can be attached to almost any computer, with an RS-232 or 20 mA current loop interface. Switches allow the user to select the operating mode including: 110-9600 baud rate, full or half duplex, even/odd/no parity, five to eight data bits, and one- or two-stop bits.



Ideal for applications where low cost and minimum size are factors, the Transactor is designed as an alternative to large or expensive CRT terminals. Practical applications include retail sales, hospital patient accounting, general accounting, inventory control, com-

puter programming, production control, and instrument monitoring.

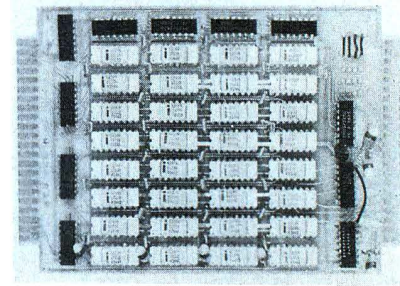
Lightweight and small, the Transactor is housed in an attractive and sturdy aluminum case that measures only 6" high x 15" wide x 11" deep. A stylized molded case is available. Price of standard Transactor 1 in quantity is $595.00.

For more information, contact Computerwise, Inc. 4006 EAst 137th Terrace, Grandview, MO 64030, (816) 765-3330.

CIRCLE INQUIRY NO. 131

16K RAM Module Under $400

WINTEK has lowered the price on their 16K byte WINCE RAM Module to $399, a 55% reduction from their $889 price last Spring. Plummeting prices from their suppliers of 4K dynamic RAMs was cited.

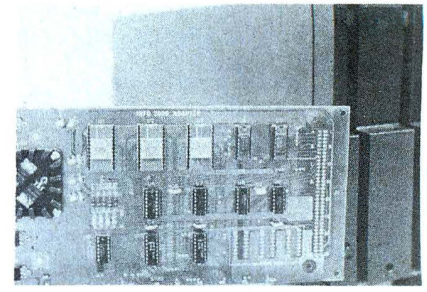


The WINCE MICRO MODULES are unique in that they are the only 6800 μP modules on industry standard 4½" x 6½" circuit boards. Other WINCE modules include the ROM, EROM PROGRAMMER, ANALOG INTERFACE, DRIVER/SENSOR and six others. New WINCE RAM module prices are 16K - $399; 12K - $339; 8K - $227; 4K - $199. WINTEK Corp., 902 N. 9th Street, Lafayette, IN 47904; (317) 742-6802.

CIRCLE INQUIRY NO. 132

INFO 2000 Adapters

INFO 2000 has for immediate delivery four new products for the microcomputer market. The first is an interface adapter for the S-100 bus computers which allows the user of PerSci diskette drives and "intelligent" controller. the adapter also has 3K of EPROM and 1K of RAM for user operating systems and scratch-pad. Kits are $120.00; assembled and tested are $195.00. EPROM and RAM chips are optional.



The second product is a similar adapter for DIGITAL GROUP computers but also has optional serial ports. The customer may order one or two optional serial ports allowing the use of RS-232 modems, terminals and printers. The price of the first serial port is $90.00 and the second is $70.00.

The third product is a DISK OPERATING SYSTEM which resides on three erasable PROMs on the INFO 2000 ADAPTERS. There is one for Z-80 S-100 bus computers and one for DIGITAL GROUP Z-80 computers. The price for the operating system and the EPROMs that it resides on is $180.00. The DOS permits the use of TDL software with the PerSci diskette system and INFO 2000 ADAPTER. This gives the user an 8K or 12K Basic Interpreter, FORTRAN, Text Editor and Word Processor and Disc Basic with the PerSci diskette system as

the reader and punch. The "intelligent" controller of PerSci has permitted INFO 2000 to adapt TDL 8K and 12K BASIC to DISC BASICS with only an additional 100 bytes of code. This makes for a very flexible DISC BASIC since the full repertoire of commands in the controller can be used in a Basic Program.

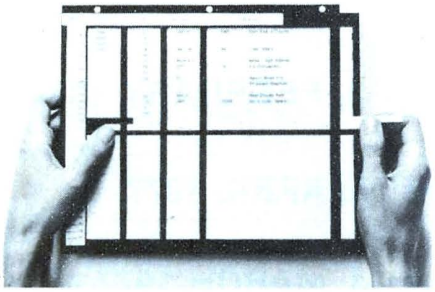
The fourth product is a complete diskette system. This includes the Model 277 PerSci dual drive and Model 1070 Controller, the INFO 2000 ADAPTER for either S-100 bus or DIGITAL GROUP bus computers, the DISC OPERATING MONITOR and all cables and connectors. This provides "just plug in and go" capability for these Z-80 computers. The price for the complete system is $2,485.00 with case and power supply included. INFO 2000 can daisy-chain these units together to achieve up to 4.4 megabyte storage capacity using IBM formatted diskettes.

For additional information, contact INFO 2000, 4901 Tara Terrace, Culver City, CA 90230, (213) 559-7121.

CIRCLE INQUIRY NO. 133

BOPA

The BOPA (Basic Operational Programming Aid) is a micro-computing aid which will help you write programs faster and more accurately. It comes with 32 removable slats, on which you write your memory entries with a special ink pen. Once your program is written on the slats, you can edit, modify, rearrange, and insert instructions by simply moving the slats around.



Memory addressing is always current and automatically updates when you make any program changes, thus making assembly and compiling of your programs quick and easy. When you are done, just copy or load your program direclty into the computer.

The BOPA is an excellent learning aid for beginners. Memory mapping is simplified. Corrections are easily made by reversing the slats or by erasure.

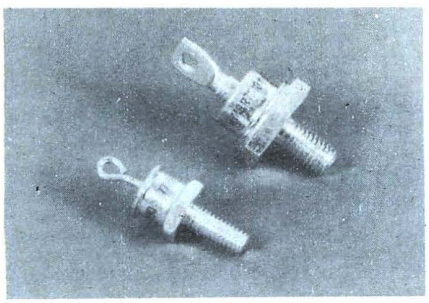
A complete set of boards can easily be carried in a three ring binder, thus allowing you to accurately program anywhere and at anytime.

For prices or further information, write VAMP, Inc., P.O. Box 29315, Los Angeles, CA 90029.

CIRCLE INQUIRY NO. 134

Improved Schottky Power Rectifiers

A series of power rectifiers that operate on the Schottky principle and advance existing performance limits has been introduced by Motorola's Discrete Semiconductor Division.



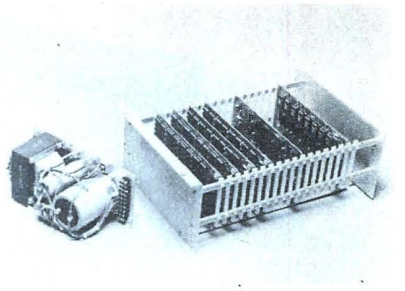
Designed specifically for high-current switching applications, the new 17-device series covers a forward current range from 25 to 75 amperes, with reverse voltage ratings up to 45 volts. Of specific importance, however, is the fact that the specifications are achieved at operating junction temperatures of 150° (Case temperature = 90°C). For most devices in the series, the dv/dt ratings are 1000 v/ms, a significant improvement in this specification over previously existing standard devices. The Schottky process also yields a forward voltage drop that is 20% less than existing standards.

For further information, contact Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036, (602) 244-6900.

CIRCLE INQUIRY NO. 135

Rack Mount for Vector 1

Vector Graphic Inc. announces a rack mount version of its popular Vector 1 computer. Kit includes card cage, 18 slot Motherboard assembled and tested with 18 connectors, card guides and locking buttons for 18 cards. The Motherboard is fully shielded to reduce noise on the bus. $225.



Heavy duty modular power supply is also available. The 18A 8V, 2.5A ± 16V custom supply provides sufficient power for full 18 boards.

For further information, contact Vector Graphic Inc., 790 Hampshire Road A-B, Westlake Village, CA 91361, (805) 497-0733.

CIRCLE INQUIRY NO. 136

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BOOK REVIEWS

8080 PROGRAMMING FOR LOGIC DESIGN

Adam Osborne. Adam Osborne & Associates, Inc., 1976.
288 pages, $7.50, paper.

Review by
Judy Scolney Robertson and Larry Robertson

8080 Programming for Logic Design is an effective introduction to microprocessors for those who have already worked with discrete digital circuitry. It is aimed at the engineer familiar with digital logic and explains, on this level, how a microprocessor works and how to use one to simulate logic design.

The book is, as the title states, about the 8080. It specifically discusses the 8080 which is available as the AMD 9080A, INTEL 8080A, NEC 8080A, TMS 8080A, and NS 8080A. It is a "how to do it" book, as Osborne calls it. The author's purpose as stated in the introduction, to explain ". . . how an assembly language program within a microcomputer can replace combinatorial logic . . .," comes through "loud and clear."

Osborne presents his data with a strong engineering orientation, and as such, does not discuss higher level languages. He considers higher level languages undesirable when using microprocessors to replace discrete digital logic, stating:

> "Higher level languages are problem-oriented. For example, it is hard to look at a PL/M program statement and visualize the exact way in which data will be moved around a microcomputer system in response to the statement's execution. It is even harder to relate PL/M programs to exact device configurations. Assembly language, on the other hand, has a one-for-one relationship with your hardware."

Osborne is so firm in this stand that he doesn't even look into using higher level languages with assembler subroutines.

8080 Programming is designed as an extremely well organized text and reference book. Each main point is presented in bold-faced type with supporting data and expansions immediately following in light-faced type. This presentation is exceptionally handy for both the serious student and the person using the book as a reference to find information on one or two subjects. The book is small, compact, and crammed full to the gills with valuable information about interfacing, instruction times, interrupts, and anything else you might want to know about in order to use effectively the 8080A processor. The complete 8080A instruction set is included in the book, each instruction being described in detail. Diagrams of where what goes when with respect to an instruction are clear and extremely helpful.

CMOS COOKBOOK

Don Lancaster. Howard W. Sams and Company, Inc., 1977.
414 pages, $9.95, paper.

Review by
Judy Scolney Robertson and Larry Robertson

The *CMOS Cookbook* is aimed at anyone interested in learning about or using CMOS, presupposing some familiarity with electronics from transistors on upwards. The book may be used as a ready reference to CMOS or as a self-teaching aid. It is very user-oriented, with a minimum of math, little theory, and a strong emphasis on applications.

The *Cookbook* starts with a general description of CMOS, covering all the basics necessary to the use and purchase of CMOS devices. (This information is also available in poster form in the companion piece, *The Big CMOS Wallchart*). The book goes on to plunge headfirst into a discussion of logic devices, each chapter getting progressively more complex. Special chapters are devoted to multivibrators, clocked-logic, counters and shift registers, and op-amps, analog switches and phase-locked loops. Chapter 8, "Getting It All Together," discusses several applications and suggests some possible future uses of CMOS devices.

Lancaster calls CMOS "the 'first hassle-free' digital logic family," reminding the reader that it is "extremely tolerant of the usual rat's-nest breadboards and poor power sources that are typical of experimentor, student, and industrial lashups."

The *CMOS Cookbook* is a comprehensive discussion of CMOS which maintains an informal tone throughout. It is an extremely valuable reference for anyone considering or actively using CMOS devices.

GETTING INVOLVED WITH YOUR *OWN* COMPUTER: A GUIDE FOR BEGINNERS

Leslie Solomon and Stanley Viet. Ridley Enslow Publishers, P.O. Box 301, Short Hills, New Jersey, 07078, 1977.
216 pages, $5.95, paper.
$9.95, hardcover.

Review by
Judy Scolney Robertson and Larry Robertson

Getting Involved with Your ***Own*** *Computer* is a marvelous guide for the novice in the home computer field. It is a well-written, easily understood introduction to computers for the layman, presupposing little knowledge of real mathematics, logic or electronics. The book begins with an introduction to data processing, including some historical notes (e.g., the mention of MANIAC, a computer used in production of the first H-bomb), and concludes with a list of suggestions on how to use and enjoy your personal machine (power control, games, business applications, home-built robots, etc.).

In addition to a thorough description of number systems (decimal, binary, octal and hex), and specific pieces of equipment, *Getting Involved* includes a list of magazines, books, catalogs, organizations and computer stores, mentioning that information about all of these sources of information is available at your neighborhood computer store. Chapter Four, "The Basic Computer System," lists and describes in general terms the basic components vital to the computer system. These are discussed in greater detail in subsequent chapters.

Chapter Twelve, "Software," adequately explains various software options, discussing firmware, machine code, assembler and higher level languages, as well as software packages. Solomon and Viet also mention where and how to buy software.

There are very few books about computers aimed at the nontechnical person, and finding one as well written and designed as *Getting Involved with Your* ***Own*** *Computer* is truly a pleasure. This is a book which can serve as a good general instruction to computers as well as an excellent review of applications and sources of information for the experienced enthusiast.

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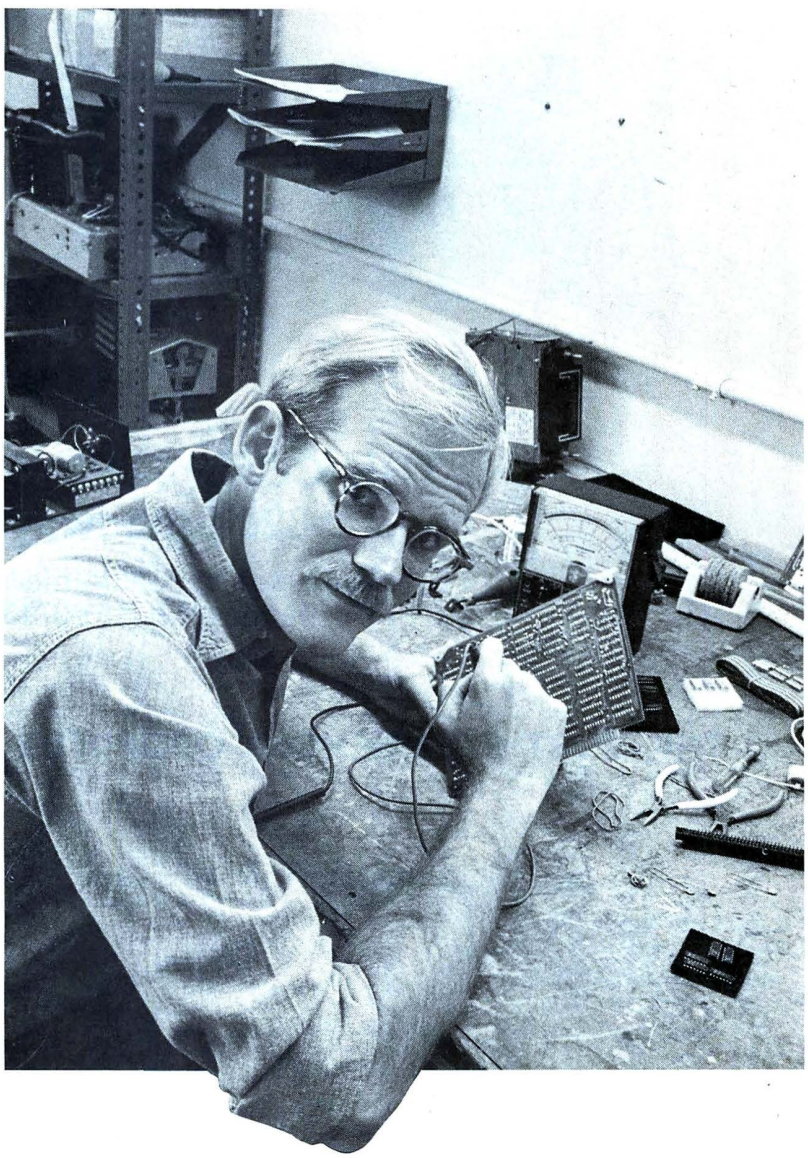

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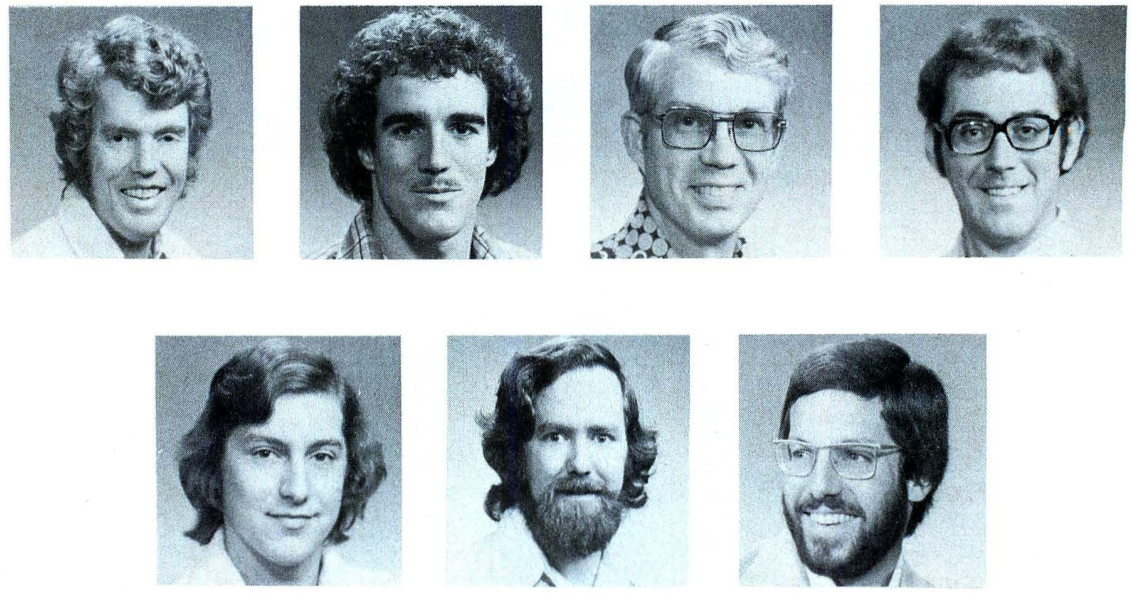

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By Robert A. Stevens
Software Editor

Software Section

SUMMARY OF SOFTWARE PROGRAMS FOR SEPTEMBER

This month's issue of INTERFACE AGE contains a wealth of software that includes two major business applications programs, and five development program articles. A summary of this software is as follows:

- GENERAL LEDGER PACKAGE, (see page 26), developed by Bud Shamburger, provides the small businessman with a complete and fully documented general ledger business application software package for the 8080 microcomputer system. This software package is written to run on a MITS 12K Extended Rev. 4.0 Disk BASIC interrupter. The software package includes the following BASIC Programs: Check Transactions, Ledger Transactions, Bank Statement, Journal Vouchers, Monthly and Year-to-Date Budget Analysis, Sort General Ledger Files, List General Ledger Chart of Accounts, List General Ledger Procedures and List All General Ledger Programs. This is the second time that any major business application program has been published in any magazine to date. INTERFACE AGE was honored to publish the first (PAYROLL — INTERFACE AGE, June 1977) and given the privilege of publishing this second major business application program. Here again INTERFACE AGE takes this opportunity for the entire microcomputer small business industry to say thanks, Bud, for sharing your software fruit once again with us. Keep them coming. What about the rest of you microcomputerists working on business application programs, how about sharing some of your software fruit with our other readers?
- DEPRECIATION SCHEDULE ANALYSIS developed by Jim Huffman provides a capital equipment depreciating analysis program that allows the small businessman to determine the most advantageous depreciation tax write-off between Straight Line, Sum of the Digits, and Variable Rate Declining Balance depreciation via crossover point analysis. As all of the old-time readers of INTERFACE AGE know, Jim Huffman is a regular contributor of small business application programs. Keep up the good work and keep them coming.
- INTELLIGENT TERMINAL developed by Jeb Long, (see page 64) provides an 8080 remote Time Share Computer (TSC) operating system to interface a VDM microcomputer to a remote time share computer via a modem. Although this software was written to interface to a remote TSC, this same operating system can be used by two 8080 microcomputer systems to communicate with each other via modems and a telephone line.
- Z-80 DEVELOPMENT SYSTEM I/O HANDLER — DISCIO PROGRAM by Richard E. Maly provides Z-80 disk type system owners with software to manipulate files using a console keyboard. DISCIO adds six additional needed disk I/O commands to the ZILOG Z-80 Floppy Disk Development System.
- 8080/Z-80 PERSCI FLOPPY DISK I/O PROGRAM by Michael Busch provides an 8080/Z-80 host computer I/O driver routine for the PerSci 1070 Floppy Disk Controller. The driver permits the user to talk directly to the PerSci controller from the microcomputer console, using the full repertoire of file management commands supported by the 1070 controller. The driver also supports high-speed transfer of disk files into and out of the host microcomputer RAM memory.
- TRANSPARENT BINARY PAPER TAPE LOAD & DUMP PROGRAMS by Jack Johnson provides a fast TTY 6800 microcomputer binary paper tape load and dump program that masks out the ASCII control characters such that they are transparent to an ASR-33 but not to a 6800 microcomputer. This Transparent Binary format allows a program to be loaded and duplicated faster than a HEX formatted paper tape program.
- BUBBLE SORT by Martin Knight provides a 6800 microcomputer bubble sort program that will sort an array of up to 255 HEX numbers and arrange them in sequential order.

ADDITIONAL EXMON PROGRAM SOFTWARE BUG

Dear Sir:

Besides the bug Mr. Stanley found (INTERFACE AGE, June, 1977, page 123), there is another bug in EXMON (Burton, INTERFACE AGE, April, 1977, page 114): EXMON loads the register stack in the wrong order. The 6800 instruction RTI loads registers from the stack in the order CC, A, B, X, but EXMON loads the registers onto the stack in the order A, B, CC, X. Obviously wrong. If one used the published EXMON to load what one thought was AA into A, BB into B, and CC into C, what actually would happen on execution of an RTI is that C would get AA, B would get BB, and A would get CC.

The bug Mr. Stanley found is that the index register is not incremented to point at SP plus 4 when the index register output routine is executed. That can be fixed by inserting an INX instruction after line 00113.

In addition, an STS $A008 should be added after line 00048. While MIKBUG does initialize $A008 to #$A042 during the reset sequence, the memory could be changed for some reason, so the re-initialization is needed as a safety precaution.

Here is a summary of changes to the EXMON source:

```
00048 EXMON     LDS #$A042
                STS $A008       new line
                •
                •
                •
00089           BNE CHKC        new label
                •
                •
                •
00095 CHKC      LDX SP          new label
                INX
                CMP B #'C       new data
                BEQ RDC
                INX
                CMP B #'A       new data
                BEQ RDC
                INX
                CMP B #'B       new data
                BNE CHKX
                •
                •
                •
00112 CHKX      CMP B #'X
                BNE CHKS
                INX             new line
                BSR OUT4HS
                •
                •
                •
```

The source should be revised as above and reassembled.

One interesting idea in implementing a monitor program in RAM for the SWTPC 6800 is to use the Non-Maskable Interrupt to jump to the monitor. That would save the need of 1. Resetting to MIKBUG, 2. Using MIKBUG M memory examine and modify function to load the starting address of the RAM monitor onto the control stack, and 3. Jumping to the RAM monitor by using MIKBUG G jump to user program function. Instead, ground the NMI line momentarily by a push button or some other method.

William R. Hamblen

MICROCOMPUTER SOFTWARE DEPOSITORY PROGRAM LISTING PRICE..$1.00

THE FOLLOWING LISTS SOFTWARE AVAILABLE FROM MSD ON A PREPAID BASIS ONLY. THE TOTAL COST OF EACH PACKAGE IS THE SUM OF THE BASIC PRICE + CALIFORNIA SALES TAX, IF APPLICABLE, + POSTAGE AND HANDLING COST. FOREIGN SUBSCRIBERS PLEASE NOTE THE DIFFERENT MAILING COST FOR POSTAGE OUTSIDE USA. ADDRESS ALL INQUIRIES TO

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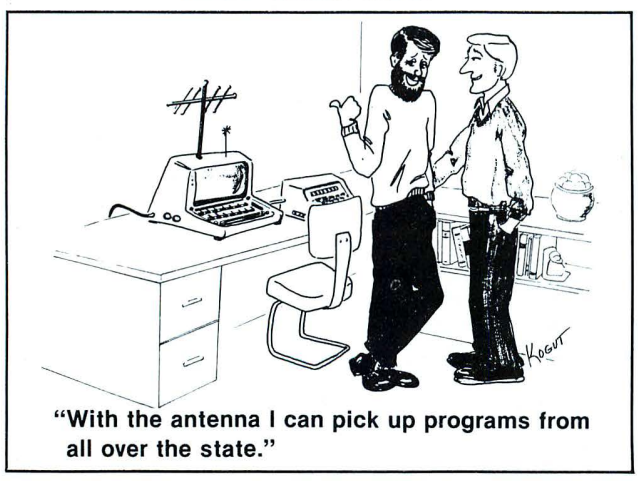
MICROCOMPUTER SOFTWARE DEPOSITORY (MSD) PROGRAMS DATE SEPT. 1977

PROGRAM MEDIA	
PTAC	PAPER TAPE ASSEMBLY CODE
PTSC	PAPER TAPE SOURCE CODE
PTOC	PAPER TAPE OBJECT CODE
PTBC	PAPER TAPE BASIC CODE

NOTES
* CALIF. SALES TAX REQUIRED FROM RESIDENCE OF CALIF.
: USA POSTAGE + HANDLING OR THIRD CLASS USA POSTAGE +



"With the antenna I can pick up programs from all over the state."

PTAL	PAPER TAPE ASSEMBLY LISTING	HANDLING OR SURFACE RATE
PTSL	PAPER TAPE SOURCE LISTING	FOREIGN POSTAGE @
PTOL	PAPER TAPE OBJECT LISTING	THREE TIMES THIRD CLASS
PTOD	PAPER TAPE OBJECT DUMP	USA POSTAGE RATE(STANDARD
PTBL	PAPER TAPE BASIC LISTING	OR SURFACE RATE FOREIGN
CTAL	CASSETTE TAPE ASSEMBLY LISTING	POSTAGE @ FIVE TIMES USA
CTSL	CASSETTE TAPE SOURCE LISTING	POSTAGE RATE (ALTERNATE)
CTOL	CASSETTE TAPE OBJECT LISTING	> NEW PROGRAM LISTING
CTOD	CASSETTE TAPE OBJECT DUMP	% VENDOR SOFTWARE PACKAGE -
CTBC	CASSETTE TAPE BASIC CODE	
CTBL	CASSETTE TAPE BASIC LISTING	
HCAC	XEROX HARD COPY OF ASSEMBLY CODE	
HCSC	XEROX HARD COPY OF SOURCE CODE	
HCOC	XEROX HARD COPY OF OBJECT CODE	
HCBC	XEROX HARD COPY OF BASIC CODE	
HCAL	XEROX HARD COPY OF ASSEMBLY LISTING	
HCALF	FULL SIZE XEROX HARD COPY OF ASSEMBLY LISTING	
HCSL	XEROX HARD COPY OF SOURCE LISTING	
HCOL	XEROX HARD COPY OF OBJECT LISTING	
HCOD	XEROX HARD COPY OF OBJECT DUMP	
HCBL	XEROX HARD COPY OF BASIC LISTING	
TEXT	XEROX HARD COPY OF PRINTED TEXT	
PTTL	PAPER TAPE TEXT LISTING	
CTTL	CASSETTE TAPE TEXT LISTING	
MAN	MANUAL	
HCGR	XEROX HARD COPY OF GRAMMAR	
PTGR	PAPER TAPE COPY OF GRAMMAR	
BBSL	XEROX HARD COPY OF BINARY BOOTSTRAP LOADER	
HBSL	XEROX HARD COPY OF HEX BOOTSTRAP LOADER	
PACK	PACKAGE PRICE INCLUDES ALL ITEMS/PROGRAM # WITH SYMBOL <	
FDOD	FLOPPY DISC OBJECT DUMP	

SUFFIX C= HAND ASSEMBLED CODE
SUFFIX L= COMPUTER FORMATED LISTING
SUFFIX D= CODE DUMP IN OCTAL OR HEX
SUFFIX F= FULL SIZE COPYY

DEFINITIONS:

ASSEMBLY LISTING: COMPUTER ASSEMBLED SOFTWARE PROGRAM LISTING THAT INCLUDES SYMBOLIC ASSEMBLY LANGUAGE SOURCE CODED INSTRUCTIONS WITH COMMENTS PLUS EQUIVALENT MACHINE LANGUAGE OBJECT CODED INSTRUCTINS AND MEMORY ADDRESS ASSIGNMENTS FOR EACH INSTRUCTION (SOURCE + OBJECT).

ASSEMBLY CODE: SAME CONTENT AS ASSEMBLY LISTING BUT HAND ASSEMBLED.

SOURCE LISTING: SOFTWARE PROGRAM LISTING RESULTING FROM COMPUTER SOFTWARE CONTROLLED ASSEMBLY PROCESS THAT INCLUDES ASSEMBLY LANGUAGE SOURCE CODED INSTRUCTIONS WITH COMMENTS. SOMETIMES, LINE STATEMENT NUMBERS ARE INCLUDED FOR EACH INSTRUCTION.

SOURCE CODE: SAME CONTENT AS SOURCE LISTING BUT HAND ASSEMBLED.

OBJECT LISTING: SOFTWARE PROGRAM LISTING RESULTING FROM COMPUTER SOFTWARE CONTROLLED ASSEMBLY PROCESS THAT ONLY INCLUDES MACHINE READABLE OBJECT CODED INSTRUCTIONS AND MEMORY ADDRESS ASSIGNMENTS.

OBJECT CODE SAME CONTENT AS OBJECT LISTING BUT HAND ASSEMBLED.

HARD COPY: XEROX OR PRINTED COPY.

CODE: HAND ASSEMBLED CODE (SOURCE, OBJECT, OR ASSEMBLY CODE).

LISTING: COMPUTER FORMATED LISTING.

DUMP: COMPUTER MEMORY DUMP.

****

MSD PROGRAMS

CPU TYPE	SYMBOLIC NAME	DESCRIPTIVE NAME	MSD # & MEDIA	P A C K	R E V #	PRICE IN $ +CALIF. TAX(*) +USA POSTAGE(:)
6502	APPLECD	6502 APPLE COMPUTER DISASSEMBLER BY ALLEN BAUM & STEPHEN WOZNIAK-INTERFACE AGE, SEPT. 1976, VOL.1,#10.	1-TEXT 1-HCAL 1-PACK			5.00+0.30+1.00 INC. WITH TEXT
8080	LPTIIHF	LOAD 8080 PAPER TAPE IN INTEL HEX FORMAT BY BURT HASHIZUME-INTERFACE AGE, OCT. 1976, VOL.1,#11.	2-PTAL 2-PTOD 2-TEXT 2-HCAL 2-PACK	 	Ø 	8.00+0.48+2.00 INC. WITH PTAL 3.00+0.18+1.00 INC. WITH TEXT
8080	BFWOA	8080 BINARY FILES WITH OPTIONAL AUTOSTART BY WILLIAM H. JORDAN-INTERFACE AGE, OCT. 1976, VOL.1,#11.	3-PTAL 3-PTOD 3-TEXT 3-HCAL 3-PACK	 	Ø 	8.00+0.48+1.00 INC. WITH PTAL 3.00+0.18+1.00 INC. WITH TEXT
6800	MINOPS	MIN OPERATING SYSTEM BY ED KEITH & DENNIS HESCOX-INTERFACE AGE, OCT. 1976, VOL.1,#11. PTAL+ INCLUDES OPERATING INSTRUCTIONS, PAPER TAPE FORMAT AND SAMPLE RUN	4-PTAL+ 4-PTOD 4-TEXT 4-HCAL 4-PACK	 	Ø 	8.00+0.48+2.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH TEXT
8080	DBBDP	DR. BEATTIE'S BASIC DIET PLANNING BY DR. BEATTIE-INTERFACE AGE, OCT. 1976, VOL.1,#11.	5-TEXT 5-HCBL 5-PTBL 5-PACK	 	Ø 	3.00+0.18+1.00 INC. WITH TEXT 8.00+0.48+2.00
6800	EZMERPS	ECHO 1, ZERO MEMORY, ECHO REVERSE & PRINT SUBROUTINES BY HOWARD BERENBON-INTERFACE AGE, OCT. 1976, VOL.1,#11.	6-PTAL 6-TEXT 6-HCAL 6-PACK	 	Ø 	5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH TEXT
8080	ESP-1	ESP-1 SOFTWARE PACKAGE BY MICHAEL SHRAYER-INTERFACE AGE, OCT. 1976, VOL.1,#11. PTGR IS PAPER TAPE COPY OF GRAMMAR.	7-PTOD 7-MAN 7-CTOD 7-MAN 7-PTGR 7-HCGR 7-PACK	<%0 	 	30.00+1.80+1.50 INC. WITH PTOD 30.00+1.80+1.50 INC. WITH CTOD 5.00+0.30+1.50 INC. WITH PTGR

8080	PTSP-1	PROCESSOR TECHNOLOGY SOFTWARE PACKAGE NO. 1 SUMMARY BY R. A. STEVENS- INTERFACE AGE, OCT. 1976, VOL.1,#11.	8-PTGR <%0 8-TEXT < 8-PACK ↑	5.00+0.30+1.50 INC. WITH PTTL
8080	ERAMMT	EXHAUSTIVE 8080 RAM MEMORY TEST PROGRAM BY T.E.TRAVIS -INTERFACE AGE, NOV. 1976, VOL.1,#12.	9-PTAL < 0 9-PTOD < 9-TEXT < 9-HCAL < 9-HCOD < 9-PACK ↑	6.00+0.36+2.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH TEXT INC. WITH TEXT
6800	MEMDMP-1	SWTPC 6800 MEMORY DUMP PROGRAM MEMDMP-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	10-PTAL < 0 10-PTSL < 0 10-PTOD < 10-TEXT < 10-HCAL < 10-PACK ↑	5.00+0.30+1.00 8.00+0.48+1.00 INC. WITH PTSL 1.00+0.06+1.00 INC. WITH TEXT
6800	ROBIT-1	SWTPC 6800 ROTATING BIT RAM MEMORY DIAGNOSTIC PROGRAM ROBIT-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	11-PTAL < 0 11-PTSL < 0 11-PTOD < 11-TEXT < 11-HCAL < 11-PACK ↑	5.00+0.30+1.00 8.00+0.48+1.00 INC. WITH PTSL 1.00+0.06+1.00 INC. WITH TEXT
6800	MEMCON-1	SWTPC 6800 SHORT MEMORY ADDRESS CONVERGENCE PROGRAM MEMCON-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	12-PTAL < 0 12-PTSL < 0 12-PTOD < 12-TEXT < 12-HCAL < 12-PACK ↑	5.00+0.30+1.00 8.00+0.48+1.00 INC. WITH PTSL 1.00+0.06+1.00 INC. WITH TEXT
6800	BJIB	BLACKJACK IN BASIC PROGRAM BY ED KEITH & DENNIS HESCOX. THE BJIB PAPER TAPE OBJECT CODE REQUIRES ROBERT UITERWYK'S SWTPC MICROBASIC OPERATING SYSTEM-INTERFACE AGE, NOV. 1976, VOL.1,#12. PTBL+ INCLUDES SAMPLE RUN, INSTRUCTIONS, LIST OF VARIABLES AND LIST OF ROUTINES.	13-PTBL 0 13-PTBL+< 13-TEXT < 13-HCBL < 13-PACK ↑	9.00+0.54+2.00 12.00+0.72+2.00 2.00+0.12+1.00 INC. WITH TEXT
6502	RFPR	REVISED FLOATING POINT ROUTINES FOR 6502* BY ROY RANKIN & STEVE WOZNIAK - INTERFACE AGE, NOV. 1976, VOL.1,#12. NOTE * - ORIGINAL MATH PACKAGE FIRST APPEARED IN DR. DOBB'S JOURNAL, AUG. 1976, VOL.1,#7.	14-PTOD < 1 14-PTAL < 14-PTSL < 14-TEXT < 14-HCAL < 14-PACK ↑	5.00+0.30+1.00 9.00+0.54+2.00 10.00+0.60+2.00 2.00+0.12+1.00 INC. WITH TEXT
6800	HISPDMUP	HIGH SPEED DOUBLE PRECISON MULTIPLICATION SUBROUTINE- HISPDMUP BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, NOV. 1976, VOL.1,#12.	15-PTAL < 0 15-TEXT < 15-HCAL < 15-PACK ↑	8.00+0.48+1.00 1.00+0.06+1.00 INC. WITH TEXT
6800	DIV16	REENTRANT 16 BIT DIVIDE SUBROUTINE - DIV16 BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, NOV. 1976, VOL.1,#12.	16-PTAL < 1 16-TEXT < 16-HCAL < 16-PACK ↑	8.00+0.48+1.00 1.00+0.06+1.00 INC. WITH TEXT
6800	RENTMUP	REENTRANT DOUBLE PRECISION MULTIPLICATION SUBROUTINE- RENTMUP BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, NOV. 1976, VOL.1,#12.	17-PTAL < 0 17-TEXT < 17-HCAL < 17-PACK ↑	8.00+0.48+1.00 1.00+0.06+1.00 INC. WITH TEXT
8080	HOMEC	COMPUTER OR CONTROLLER BY TERRY BENSON, INTEL - INTERFACE AGE, SEPT. 1976, VOL.1,#10.	18-PTAL < 0 18-PTSL < 18-TEXT < 18-HCAL < 18-PACK ↑	5.00+0.30+1.00 5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH TEXT
8080	LCST	STARTREK BY LYNN COCHRAN- INTERFACE, JUNE 1976, VOL.1,#7.	19-PTBL < 0 19-TEXT < 19-HCBL < 19-PACK ↑	7.00+0.42+1.00 3.00+0.18+1.00 INC. WITH TEXT
8080	WSPG	WORD SEARCH PUZZLE GENERATOR BY RICHARD S. EDELMAN - INTERFACE, JULY 1976, VOL.1,#8.	20-PTBL < 0 20-TEXT < 20-HCBL < 20-PACK ↑	6.00+0.36+1.00 2.00+0.12+1.00 INC. WITH TEXT
8080	PGBIORHY	BIORHYTHM BY PAUL GREEN - INTERFACE AGE, AUG. 1976, VOL.1,#9.	21-PTBL < 0 21-TEXT < 21-HCBL < 21-PACK ↑	6.00+0.36+1.00 1.00+0.12+1.00 INC. WITH PTBL
8080	WDBIORHY	BIORHYTHMS IN PRACTICE BY WILLIAM L. DONHAN, M.D. - INTERFACE AGE, AUG. 1976, VOL.1,#9.	22-PTBL < 0 22-TEXT < 22-HCBL < 22-PACK ↑	8.00+0.48+2.00 2.00+0.12+1.00 INC. WITH TEXT
8080	REBJ	BLACKJACK BY RICHARD S. EDELMAN - INTERFACE AGE, AUG. 1976, VOL.1,#9.	23-PTBL < 0 23-TEXT < 23-HCBL < 23-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH TEXT
8080	BLUFF	BLUFF BY PHIL FELDMAN & TOM RUGE - INTERFACE AGE, SEPT. 1976, VOL.1,#10.	24-PTBL < 0 24-TEXT < 24-HCBL < 24-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH TEXT
6800	RABSIMB	RELATIVE ADDRESS BACK-STEPPER IN MICRO-BASIC BY J. HUFFMAN - INTERFACE AGE, DEC. 1976, VOL.1,#13.	25-PTBL < 0 25-HCBL < 25-TEXT < 25-PACK ↑	5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH HCBL
6800	TEFT6800	TEXT EDITOR FOR THE SWTPC-6800 BY MARK BORGERSON - INTERFACE AGE, DEC. 1976, VOL.1,#13. HCAL IS COPY OF FULL SIZE ASSEMBLY LISTING.	26-PTAL < 0 26-PTOD < 26-HCAL < 26-TEXT < 26-PACK ↑	15.00+0.90+2.00 10.00+0.60+2.00 3.00+0.18+1.50 2.00+0.12+1.25
8080	WPATBX	WANG'S PALO ALTO TINY BASIC BY ROGER RAUSKOLB - INTERFACE AGE, DEC. 1976, VOL.1,#13. HCAL & HCSL ARE COPIES OF FULL SIZE CODE	27-PTSL < 0 27-PTOD < 27-HCAL < 27-TEXT < 27-HCSL < 27-PACK ↑	20.00+1.20+3.00 10.00+0.60+2.00 4.00+0.24+1.50 INC. WITH HCAL 4.00+0.24+1.50
8080	LLLBI	LLL 8080 BASIC INTERPRETER GRAMMAR BY JERRY BARBER & ROYCE ECKARD - SUBMITTED BY E.R. FISHER - INTERFACE AGE, DEC. 1976,VOL.2,#1(PART 1). JAN. 1977,VOL.2,#2(PART 2), FEB. 1977,VOL.2,#3(PART 3), MARCH 1977,VOL.2,#4(PART 4). TEXT1 IS PART 1, TEXT2 IS PART 2, ETC. HCAL2,3, & 4 ARE FULL SIZE XEROX COPIES OF ASSEMBLY PROGRAM LISTINGS OF PARTS 2,3, & 4.	28-TEXT1< 0 28-PTSL2< 28-HCAL2< 28-TEXT2< 28-PTSL3< 28-HCAL3< 28-TEXT3< 28-PTSL4< 28-TEXT4< 28-HCAL4< 28-PACK ↑	5.00+0.30+2.00 57.00+3.42+6.00 5.00+0.30+2.00 3.00+0.18+2.00 36.00+2.16+4.00 5.00+0.30+2.00 3.00+0.18+2.00 15.00+0.90+2.00 3.00+0.18+2.00 3.00+0.18+2.00
SC/MP	NIBL	NIBL-NATIONAL'S TINY BASIC GRAMMAR FOR SC/MP BY PHIL ROYBAL - INTERFACE AGE, DEC. 1976, VOL.2, #1. ASSEMBLY LISTING PUBLISHED JAN. 1977, VOL.2,#1.	29-TEXT < 0 29-HCAL < 29-PTSL < 29-PTOD < 29-PTGR < 29-PACK ↑	5.00+0.30+2.00 10.00+3.00+2.00 10.00+3.00+2.00 5.00+0.30+1.00 2.00+0.12+1.00
SC/MP	MWBAGELS	BAGELS BY DR. MARVIN WINZINREAD BY PERMISSION & COURTESY OF NATIONAL SEMICONDUCTOR - INTERFACE AGE, DEC. 1976, VOL.2,#1.	30-PTBL < 0	5.00+0.30+2.00
8080	AMS80	AMSAT 8080 STANDARD DEBUG MONITOR BY RICHARD C ALLEN & JOE KASSER - BYTE # 13, SEPT. 1976, VOL.2,#1. SUBMITTED BY JOE KASSER.	31-PTSL < 2 31-PTOD < 31-PACK ↑	15.00+0.90+2.00 5.00+0.30+2.00
6800	BAFCMP	BASIC ALGORITHMS FOR COMMON MATH FUNCTIONS BY MICHAEL P. BURTON - INTERFACE AGE, JAN. 1977, VOL.2,#2.	32-PTBL < 1 32-TEXT < 32-PACK ↑	6.00+0.36+1.00 2.00+0.12+1.00
8080	ECMSO	MICROCOMPUTER STOCK OPTIONS BY EDWARD CHRISTIANSON - INTERFACE AGE, FEB. 1977, VOL.2,#3.	33-PTBL < 0 33-HCBLF 33-HCBLF< 33-TEXT < 33-PACK ↑	15.00+0.90+2.00 5.00+0.30+2.00 INC. WITH PTBL 5.00+0.30+2.00
8080	BMRNG	RANDOM NUMBER GENERATOR BY BOB MARTIN - INTERFACE AGE, FEB. 1977, VOL.2,#3.	34-PTAL < 0 34-PTSL < 34-TEXT < 34-HCALF 34-HCALF< 34-PACK ↑	7.00+0.42+2.00 6.00+0.36+2.00 2.00+0.12+1.00 4.00+0.24+1.00 INC. WITH PTAL
8080	RNDFGCST	RND FUNCTION GENERATOR CHI-SQUARE TEST PROGRAM BY BOB MARTIN - INTERFACE AGE, FEB. 1977, VOL.2,#3.	35-PTBL < 35-HCBLF< 35-PACK ↑	4.00+0.24+1.00 INC. WITH PTBL
8080	TTMOCSR	8080 MEMORY OBJECT CODE SEARCH ROUTINE BY T. E. TRAVIS - INTERFACE AGE, FEB. 1977, VOL.2,#3.	36-PTAL < 0 36-PTSL < 36-TEXT < 36-HCALF< 36-HCALF 36-PACK ↑	5.00+0.30+1.00 5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH TEXT 2.00+0.12+1.00
8080	TDOMP	8080 OCTAL MONITOR PROGRAM BY THOMAS E. DOYLE - INTERFACE AGE, FEB. 1977, VOL.2,#3.	37-PTAL < 0 37-PTSL < 37-TEXT < 37-HCALF 37-HCALF< 37-PTOD < 37-PACK ↑	8.00+0.48+2.00 8.00+0.48+2.00 2.00+0.12+1.00 4.00+0.24+1.00 INC. WITH PTAL 5.00+0.30+1.50
8080	LLLBFPMP	LLLBASIC FLOATING POINT MATH PACKAGE BY DAVID MEAD & MODIFIED BY HAL BRAND AND FRANK OLKEN - INTERFACE AGE, FEB. 1977, VOL.2,#3.	38-TEXT < 0 38-HCALF< 38-PTSL < 38-PACK ↑	3.00+0.18+2.00 5.00+0.30+2.00 36.00+2.16+4.00
8080	Z80MFBP	Z80 MITS 12K EXTENDED BASIC PATCHES BY MARTIN D. GRAY - INTERFACE AGE, MARCH 1977, VOL.2,#4.	39-TEXT < 0 39-HCALF< 39-PACK ↑	1.00+0.06+1.00 1.00+0.06+1.00
6502	RJBAST	6502 APPLE STAR-TREK BY ROBERT J. BISHOP - INTERFACE AGE, APRIL 1977, VOL.2,#5.	40-TEXT < 0 40-HCBL < 40-PACK ↑	3.00+0.18+1.00 INC. WITH TEXT
6800	AMIPROTO	AMI'S PROTO DEVELOPMENT SOFTWARE FOR EVK SERIES PROTOTYPING BOARDS BY PERMISSION AND COURTESY OF AMERICAN MICROSYSTEMS EDITED BY R.A.STEVENS- INTERFACE AGE, FEB. 1977, VOL.2,#3.	41-TEXT < 0 41-HCALF< 41-PACK ↑	3.00+0.18+1.00 5.00+0.30+2.00
8080	CONSOL	CONSOL 1K RESIDENT OPERATING SYSTEM BY PERMISSION AND COURTESY OF PROCESSOR TECHNOLOGY- INTERFACE AGE, JAN. 1977, VOL.2,#2.	42-TEXT < 0 42-HCALF< 42-PACK ↑	3.00+0.18+1.00 5.00+0.30+2.00
8080	ODT-80	LLL BASIC OCTAL DEBUGGING PROGRAM BY E. R. FISHER- INTERFACE AGE, MARCH 1977, VOL.2,#4.	43-TEXT < 0 43-HCALF< 43-PACK ↑	3.00+0.18+2.00 5.00+0.30+2.00
6800	(RS)*3	RESIDENT 6800 REENTRANT SELF-RELATIVE SUBROUTINE PACKAGE FOR EVK 6800 MICROCOMPUTER BOARDS BY PERMISSION AND COURTESY OF AMERICAN MICROSYSTEMS EDITED BY R.A. STEVENS-	44-TEXT < 0 44-HCALF< 44-PACK ↑	3.00+0.18+1.00 5.00+0.30+2.00

CIRCLE INQUIRY NO. 75

		INTERFACE AGE, MARCH 1977, VOL.2,#4.		
6800	EXMON	6800 MIKBUG EXTENDED MONITOR SYSTEM BY MICHAEL BURTON- INTERFACE AGE, APRIL 1977, VOL.2,#5.	45-TEXT < Ø 45-HCALF< 45-PTAL < 45-PTOD < 45-PACK ↑	2.00+0.12+1.00 3.00+0.18+1.50 9.00+0.54+2.00 5.00+0.30+2.00
8080	LMCOS	8080 CASSETTE OPERATING SYSTEM (COS) BY LORIN MOHLER- INTERFACE AGE, APRIL 1977, VOL.2,#5.	46-TEXT < 46-PTSL < 46-HCALF< 46-PACK ↑	3.00+0.18+1.00 10.00+0.60+2.00 5.00+0.30+1.00
6800	MHFTIHFC	MOTOROLA 6800 HEX FORMAT TO INTEL FORMAT SOFTWARE CONVERTER BY FLOYD NORDIN- INTERFACE AGE, APRIL 1977, VOL.2,#5.	47-TEXT < Ø 47-PTAL < 47-PTSL < 47-PTOD < 47-HCALF< 47-HCODF< 47-PACK ↑	1.00+0.06+1.00 5.00+0.30+2.00 5.00+0.30+2.00 3.00+0.18+1.00 3.00+0.18+1.00 INC. WITH HCAL
8080	MMGTEN	GRAPHICS- THE EASY WAY BY MARVIN MALLON- INTERFACE AGE, MARCH 1977, VOL.2,#4.	48-TEXT Ø 48-HCRLF	3.00+0.18+1.00 5.00+0.30+1.00
8080	CBMS	BYTEMOVER SOFTWARE FOR THE CROMEMCO 8K BYTESAVER BOARD - PERMISSION AND COURTESY OF CROMEMCO EDITED BY ROGER EDELSON- INTERFACE AGE, JAN. 1977, VOL.2,#2.	49-TEXT Ø 49-HCAL	5.00+0.30+1.00 INC. WITH TEXT
8080/ Z80	FNOCDA	8080/Z80 OBJECT CODE DIS-ASSEMBLER BY FLOYD L. NORDIN- STANDARD VERSION HANDLES UP TO 1K LABLES & ASSIGNS SYMBOLIC NAMES. ASCII CHARACTER LIST PIN POINTS EMBEDDED TABLES. INCLUDES BOTH ASSEMBLY AND SOURCE OUTPUT MODES VIA YOUR OUTPUT DRIVERS. PROGRAM RESIDES AT TOP OF MEMORY. STANDARD VERSIONS AVAILABLE FOR 16K, 24K, 32K, 48K AND 64K BYTES OF MEMORY. OTHER VERSIONS WITH ADDITIONAL LABLE SPACE AND/OR DIFFERENT MEMORY SIZE ARE AVAILABLE.	50-PTOD <Ø 50-MAN < 50-PACK ↑	40.00+2.40+2.00 5.00+0.30+1.00 45.00+2.70+3.00
6800	SWTPMB	SWTP'S 6800 MICROBASIC VER. 1.4 BY ROBERT H. UITERWYK AND BY PERMISSION & COURTESY OF SOUTHWEST TECHNICAL PRODUCTS CORP. SWTPC 6800 COMPUTER NEWSLETTER #1, JUNE 1976.	51-PTOD Ø	15.00+0.90+2.00
6800	EVKMB	SWTP'S 6800 MICROBASIC VER. 1.4 MODIFIED FOR AMI'S 6800 EVK MICROCOMPUTER BOARDS BY STEVEN D. WALL.	52-PTOD Ø	15.00+0.90+2.00
8080	CCOKEN	ARTIFICAL INTELLIGENCE TIC-TAC-TOE PROGRAM (OR MENACE OF THE MICROWORLD) BY KEN BERKUM -INTERFACE AGE, MARCH 1977, VOL.2,#4.	53-PTBL < Ø 53-TEXT < 53-HCBL < 53-HCBL 53-PACK ↑	10.00+0.60+2.00 2.00+0.12+1.00 INC. WITH PTBL 2.00+0.12+1.00
6800	JHDOTWP	DAY OF THE WEEK PROGRAM BY JIM HUFFMAN-INTERFACE AGE, APRIL 1977, VOL.2,#5.	54-PTBL < Ø 54-TEXT < 54-HCBL < 54-HCBL 54-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH PTBL 1.00+0.06+1.00
6800	JHCBBP	CHECKROOK BALANCER PROGRAM BY JIM HUFFMAN - INTERFACE AGE, APRIL 1977, VOL.2,#5.	55-PTBL < Ø 55-TEXT < 55-HCBL < 55-HCBL 55-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH PTBL 1.00+0.06+1.00
8080	HEXDUMP	INTEL HEX FORMAT PAPER TAPE DUMP PROGRAM BY ALAN R. MILLER - INTERFACE AGE, APRIL 1977, VOL.2,#5.	56-PTAL < 1 56-PTSL < 56-PTOD < 56-HCAL < 56-HCAL 56-HCSL < 56-HCSL 56-PACK ↑	8.00+0.48+2.00 8.00+0.48+2.00 5.00+0.30+1.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH PTSL 2.00+0.12+1.00
8080	CONVERT1	NUMBER BASE CONVERSION- NON DISC VERSION BY JOHN W. SWAIN- INTERFACE AGE, APRIL 1977, VOL.2,#5.	57-PTBL < Ø 57-TEXT < 57-HCBL < 57-HCBL 57-PACK ↑	7.00+0.42+1.00 2.00+0.12+1.00 INC. WITH PTBL 1.00+0.06+1.00
8080	CONVERT2	NUMBER BASE CONVERSION- DISC BASED VERSION OF CONVERT1 ABOVE BY JOHN W. SWAIN - INTERFACE AGE, APRIL 1977, VOL.2,#5.	58-PTBL < Ø 58-TEXT < 58-HCBL < 58-HCBL 58-PACK ↑	7.00+0.42+1.00 2.00+0.12+1.00 INC. WITH PTBL 1.00+0.06+1.00
Z80	SERIAL	USER TTY HANDLER FOR THE Z80 DELEVOPMENT SYSTEM BY RICHARD E. MALY - INTERFACE AGE, APRIL 1977, VOL.2,#5.	59-TEXT Ø 59-HCAL 59-PTOD < 59-PTAL < 59-PTSL < 59-PACK ↑	3.00+0.18+1.00 2.00+0.12+1.00 10.00+0.60+2.00 INC. WITH PTOD INC. WITH PTOD
6800	MEMTEST	A BETTER 6800 MEMORY TEST BY ED KEITH- INTERFACE AGE, APRIL 1977, VOL.2,#5.	60-PTAL < Ø 60-PTSL < 60-PTOD < 60-TEXT < 60-HCAL < 60-HCAL 60-HCSL < 60-HCSL 60-PACK ↑	8.00+0.48+2.00 8.00+0.48+2.00 3.00+0.18+1.00 2.00+0.12+1.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH PTSL 2.00+0.12+1.00
8080	AMLIFE	JOHN CONWAY'S GAME OF LIFE PROGRAMMED BY ALAN R. MILLER -INTERFACE AGE, APRIL 1977, VOL.2,#5.	61-PTAL < 4 61-PTSL < 61-PTOD < 61-TEXT < 61-HCAL <	15.00+0.90+2.00 10.00+0.60+2.00 5.00+0.30+1.00 2.00+0.12+1.00 INC. WITH PTAL

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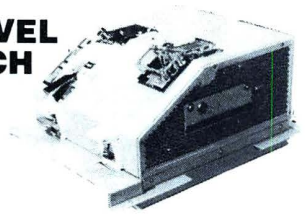

This paper tape I/O station operates at 50 cps. The mechanisms share a common drive motor but are electrically independent. 24 volt signals are required to interface the internal solenoids. An interfacing manual is included. Perfect for typesetting, program distribution, program entry and many other paper tape applications.

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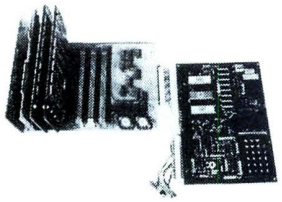

Item		Kit Price	Assembled Price
Kimsi Backplane/S-100 Adapter	8 slots for S-100 available	$125	$165
Kimsi Power Supply	Unreg. +8@10A; +16@1A; −16@1A	60	75
KIM-1 incl. documentation	Send for more information	N/A	245
KIM to Kimsi Connector Set	Includes recorder cables	8	11
S-100 Edge Connector	Kimsi accepts 8; 1 is supplied	5	7
Cassette Recorder for KIM-1	Hundreds sold for KIM use	N/A	55
4K Seals ROM Board	Accepts up to 16 1702A or 5203's	119	179
4K Imsai RAM Board	Bare minimum to run Tiny BASIC	139	239
8K Cromenco ROM Board	Accepts up to 8 2708 EPROMs	145	245
8K Seals RAM Board	Enough space for programs below	269	369
Poly Video Terminal Interface 16 x 64	Connects to a Monitor and Keyboard	210	280
Matrox 2480 Alpha-Numeric VRAM	24 lines of 80 char. (needs P39)	N/A	295
Matrox 256-ALT Video Graphics Board	Displays 256 x 256 array	N/A	395
Itty Bitty Tiny BASIC	2.5K; kit is a paper tape	5	10
Focal (a DEC trademark)	Includes floating points	N/A	40
6502 Assembler with Source	This is NOT the MOS version	N/A	30

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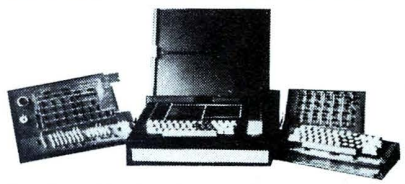

A super buy on these used keystations allows us to sell them at this low price. These attractive units contain a Hollerith-style keyboard which is easily modified to output ASCII alpha codes (we provide documentation). The interior of the enclosure is large enough for a KIM-1 and power supply. We also have a limited supply of keystation components:

Item	Price		
50 key keyboard Mounts on 11.5" centers	$19	**Incandescent Display Board** Contains over 130 lamps	3
Keystation Enclosure Dimensions 16" × 16" × 4"	19	**Display Controller Board** 38 IC's and a Sonalert	5
Copy Stand and Holder Mounts on top of enclosure	5		

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DEC PDP8/I or L with 4K core memory Table-top or floor models available	as low as 795.00

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MTX 816 Module (Upper Case only)	Composite video output in 8 lines of 16 chars	179.00
MTX 1632 Module (Upper and Lower Case)	16 x 32 display includes blink option	225.00
MTX 1632SL Module (Great with 2562)**	Slave sync allows text superposition	225.00
MTX 2480 Circuit Board	24 x 80 requires high-persistence phosphor (P39)	395.00
MTX 2562 Circuit Board**	256 x 256 array graphics (multiples provide color)	630.00

BOOKS

Programming Microprocessors	Including arithmetic with floating points	$ 6.95
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			61-HCAL	2.00+0.12+1.00
			61-HCSL <	INC. WITH PTSL
			61-HCSL	2.00+0.12+1.00
			61-PACK ↑	
8080	SFSL	STAR LANES PROGRAM BY STEVEN FABER - INTERFACE AGE, APRIL 1977, VOL.2,#5.	62-PTBL < 0	15.00+0.60+2.00
			62-HCBL <	2.00+0.12+1.00
			62-TEXT <	2.00+0.12+1.00
			62-HCBL <	INC. WITH PTBL
			62-HCBL	2.00+0.12+1.00
			62-PACK ↑	
6800	HDSS	SHOOTING STARS TBX PROGRAM BY HERMAN DEMONSTOY - INTERFACE AGE, JUNE 1977, VOL.2,#7.	63-PTBL < 0	10.00+0.60+2.00
			63-HCBL <	2.00+0.12+1.00
			63-TEXT <	2.00+0.12+1.00
8080	PAYROLL	PAYROLL PROGRAM IN BASIC BY BUD SHAMBURGER - INTERFACE AGE, JUNE 1977, VOL.2,#7.	64-PTBL < 0	20.00+1.20+2.00
			64-HCBL <	5.00+0.30+2.00
			64-TEXT <	2.00+0.12+1.00
			64-PACK ↑	
8080	TCOS	D&M'S TAPE CASSETTE SOFTWARE OPERATING SYSTEM FOR THE 8080 MICROCOMPUTER -SUMMARY BY R.A. STEVENS - INCLUDES 8080 ASSEMBLER + LINE TEXT EDITOR + MONITOR - TAPE FORMAT IS DON TARBELL'S OR PROCESSOR TECHNOLOGY'S CUTS STANDARD. INTERFACE AGE, JULY 1977, VOL.2,#8.	65-CTOD < 0	30.00+1.80+2.00
			65-MAN <	5.00+0.30+1.00
8080	PTOS	D&M'S PAPER TAPE SOFTWARE OPERATING SYSTEM FOR THE 8080 MICROCOMPUTER-SUMMARY BY R.A. STEVENS -SAME AS TCOS #65-CTXX BUT FOR ASR 33 TTY I/O SYSTEM- INTERFACE AGE, JULY 1977, VOL.2,#8.	66-PTOD < 0	30.00+1.80+2.00
			66-MAN <	5.00+0.30+1.00
8080	DOSE	D&M'S DISC SOFTWARE OPERATING SYSTEM EXTENSION FOR THE NORTH STAR 8080 FLOPPY DISC OPERATING SYSTEM - SUMMARY BY R.A. STEVENS - ADDS TCOS/PTOS FUNCTIONS TO PROVIDE FULL OPERATING SYSTEM CAPABILITIES TO THE LIMITED NORTH STAR FLOPPY DISC SOFTWARE OPERATING SYSTEM. PROGRAM MEDIA IS A NORTH STAR FLOPPY DISC.- INTERFACE AGE, JULY 1977, VOL.2,#8.	67-FDOD < 0	60.00+3.60+3.00
			67-MAN <	5.00+0.30+1.00
SC/MP	SSEIKOPP	SC/MP SEIKO PRINTER INTERFACE AND PROGRAM BY PHILIP ROYBAL - INTERFACE AGE, MAY 1977, VOL.2,#6.	68-PTSL < 0	
			68-PTOD <	
			68-HCSL <	
			68-HCOD <	
			68-TEXT <	
			68-PACK ↑	15.00+0.90+2.00
Z80	RASST	Z80 SUPER STAR TREK MODIFIED BY ROGER AMIDON. RUNS ON TDL'S Z80 8K BASIC	69-PTBL < 0	10.00+0.60+2.00
			69-HCBL <	2.00+0.12+1.00
			69-PACK ↑	
8080	DODR	DIABLO OUTPUT DRIVER ROUTINE BY CHRIS TARRY - INTERFACE AGE, JULY 1977, VOL.2,#8.	70-PTOD < 0	
			70-PTSL <	
			70-PTAL <	
			70-TEXT <	
			70-PACK ↑	15.00+0.90+2.00
6800	IOTST	6800 PIA I/O TEST PROGRAM BY WILLIAM C. WRARY OF MOTOROLA & PERMISSION AND COURTESY OF MOTOROLA'S 6800 USER GROUP LIBRARY - INTERFACE AGE, JULY 1977, VOL.2,#8.	71-PTOD < 0	7.00+0.42+1.50
			71-PTSL <	10.00+0.60+2.00
			71-TEXT <	INC. WITH PTSL
			71-HCOD <	2.00+0.12+1.00
			71-HCSL <	3.00+0.18+1.00
			71-PACK ↑	
8080	TICTAC	TIC TAC TOE GAME IN BASIC BY BUD SHAMBURGER - INTERFACE AGE, JULY 1977, VOL.2,#8.	72-PTBL	7.00+0.42+2.00
8080	BOWL	BOWL GAME IN BASIC BY BUD SHAMBURGER - INTERFACE AGE, JULY 1977, VOL.2,#8.	73-PTBL	7.00+0.42+2.00
6800	BILOAD	HIGH DENSITY TAPE LOAD BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY - INTERFACE AGE, AUG. 1977,VOL.2,#9.	74-PTSL < 0	8.00+0.48+1.00
			74-HCSL <	INC. WITH PTSL
			74-HCSL	2.00+0.12+1.00
			74-TEXT <	1.00+0.06+1.00
			74-PACK ↑	
6800	BIPUNCH	HIGH DENSITY BINARY TAPE PUNCH BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, AUG. 1977, VOL.2,#9.	75-PTSL < 0	8.00+0.48+1.00
			75-HCSL <	INC. WITH PTSL
			75-HCSL	2.00+0.12+1.00
			75-TEXT <	1.00+0.06+1.00
			75-PACK ↑	
	LMT	LOCAL MEAN TIME BY JAMES J. BRENNAN - INTERFACE AGE, AUG. 1977, VOL.2#9.	76-PTBL < 0	3.00+0.18+1.00
			76-HCBL <	INC. WITH PTBL
			76-TEXT <	1.00+0.06+1.00
			76-PACK ↑	
	ASTRON	LOCAL SIDEREAL TIME & DATE BY JAMES J. BRENNAN - INTERFACE AGE, AUG. 1977, VOL.2,#9.	77-PTBL < 0	10.00+0.60+1.00
			77-HCAL <	INC. WITH PTBL
			77-TEXT <	2.00+0.12+1.00
			77-HCBL	2.00+0.12+1.00
			77-PACK ↑	
6800	MKBSORT	BUBBLE SORT BY MARTIN KNIGHT - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	78-PTOD < 0	3.00+0.18+1.00
			78-HCOD <	INC. WITH PTOD
			78-HCAL <	"
			78-TEXT <	1.00+0.06+1.00
			78-PACK ↑	4.00+0.24+2.00
6800	LTBPT	LOAD TRANSPARENT BINARY PAPER TAPE BY JACK D. JOHNSON- INTERFACE AGE, SEPT. 1977, VOL.2,#10.	79-PTOD < 0	3.00+0.18+1.00
			79-PTSL <	6.00+0.36+1.50
			79-PTAL <	7.00+0.42+1.50
			79-HCOD <	1.00+0.06+1.00
			79-HCSL <	1.00+0.06+1.00

		79-HCAL <	1.00+0.06+1.00	
		79-TEXT <	2.00+0.12+1.00	
		79-PACK ↑		
6800	PTBPT	PUNCH TRANSPARENT BINARY PAPER TAPE BY JACK D. JOHNSON - INTERFACE AGE, SEPT. 1977,VOL.2,#10.	80-PTOD < 0	3.00+0.18+1.00
			80-PTSL <	6.00+0.36+1.50
			80-PTAL <	7.00+0.42+1.50
			80-HCOD <	1.00+0.06+1.00
			80-HCSL <	1.00+0.06+1.00
			80-HCAL <	1.00+0.06+1.00
			80-TEXT <	2.00+0.12+1.00
			80-PACK ↑	
6800	JHDSAP	DEPRECIATION SCHEDULE ANALYSIS PROGRAM BY JIM HUFFMAN - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	81-PTBL < 0	5.00+0.30+1.00
			81-HCBL <	2.00+0.12+1.00
			81-TEXT <	2.00+0.12+1.00
			81-PACK ↑	
8080	JHDSAP	DEPRECIATION SCHEDULE ANALYSIS PROGRAM BY JIM HUFFMAN - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	82-PTBL < 0	5.00+0.30+1.00
			82-HCBL <	2.00+0.12+1.00
			82-TEXT <	2.00+0.12+1.00
			82-PACK ↑	
8080	PERSCIIO	8080/Z80 I/O DRIVER PROGRAM FOR THE PERSCI 1070 INTELLIGENT DISKETTE BY MICHAEL D. BUSCH -INTERFACE AGE, SEPT. 1977, VOL.2,#10.	83-PTOD < 0	3.00+0.18+1.00
			83-PTSL <	5.00+0.30+1.00
			83-HCAL <	2.00+0.12+1.00
			83-TEXT <	2.00+0.12+1.00
			83-PACK ↑	
8080	BSGLP	GENERAL LEDGER PACKAGE BY BUD SHAMBURGER - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	84-PTBL < 0	
			84-HCBL <	
			84-TEXT <	
			84-PACK ↑	
8080	GLTSCOS	TIMESHARE COMPUTER OPERATING SYSTEM BY JEB LONG - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	85-PTOD < 0	10.00+0.60+2.00
			85-PTSL <	20.00+1.20+3.00
			85-HCOD <	2.00+0.12+1.00
			85-HCSL <	4.00+0.24+1.00
			85-PACK ↑	
6800	STARS	STARS BY ED KEITH-INTERFACE AGE, SEPT. 1977, VOL.2,#10.	86-PTOD < 0	5.00+0.30+2.00
			86-PTSL <	10.00+0.60+3.00
			86-HCOD <	1.00+0.06+1.00
			86-PACK ↑	
8080	JSVCHASE	VIDEO CHASE FOR 8080/VDM BY JOSEPH JAY SANGER-INTERFACE AGE, SEPT. 1977, VOL.2,#10.	87-PTOD < 0	10.00+0.60+2.00
			87-PTSL <	15.00+0.90+3.00
			87-HCOD <	3.00+0.18+1.00
			87-HCSL <	3.00+0.18+1.00
			87-HCAL <	5.00+0.30+1.00
			87-TEXT <	3.00+0.18+1.00
			87-PACK ↑	
	WMBIORHY	BIORYTHM BY W. MITCHELL - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	89-PTBL < 0	
			89-HCBL <	
			89-TEXT <	
			89-PACK ↑	

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DEPRECIATION SCHEDULE ANALYSIS PROGRAM—JHDSAP

by Jim Huffman

INTRODUCTION

Why is it that only the big businesses get all the big dollar write-offs, and most small businesses don't do their very best to save every possible penny? The problem, of course is that the big business has access to a gigantic monstrosity of a computer sitting in its own air-conditioned room, pumping out all the facts, figures and information that a business needs to run thoroughly and efficiently. On the other hand, the small businessman must rely on "flying by the seat of his pants." The microprocessor has the potential of allowing the small businessman to take advantage of "dollar efficient" situations.

BASIC PROGRAM

The microprocessor is coming of age and new software is being developed daily. The following program is one such item of software. It is an incredibly valuable tool for the small and medium sized business allowing the inspection of possible depreciation approaches for capital equipment. The program will determine crossover point for variable rate declining balance and straightline depreciation. This program adds up to an excellent tool for the small business to keep track of what is going on internally and to gain the maximum tax advantage available under the law.

The program was written in BASIC with prompting characters and inputs done in plain, understandable business English. Its solutions are printed out in a clear, easy-to-read and understandable form. The ease of data entry allows evaluation of the same depreciation requirement over several different methods. This is an invaluable aid when determining the best way to depreciate a given item. Basically, the algorithms on which this program is based are complicated mathematical formulae. However, I have enclosed a chart of the formulae used which have been written in a little more understandable form, as Figure 3.

PROGRAM EXECUTION

The program itself is straight-forward. There is an executive routine which does all the prompting of the main characters, as shown in the I/O flow chart in Figure 1. It gives you various programs that you select by inputting your selection as either 1, 2, 3, 4, or 5. These are: straightline depreciation, sum-of-the-year digits, variable-rate declining balance, crossover-point, and data entries, in that order. All the special characters which are prompted by the subroutine are shown in the flow chart. When the program begins, you select Number 5. this gives you data entry. The computer first prompts with starting book value, then you enter in the starting value of the item which you have; next you enter the salvage value (which is the salvage value of the equipment at the end of its life and can be zero), and the last variable input is life. Variables are then carried back into the executive routine where you may select either 1, 2, 3, or 4 and examine the data that were input at 5 for any or all the depreciation rates. Still looking at Figure 1, you would select Number 5 for data entry. Perhaps the starting book value for a piece of equipment would be $30,000. The salvage value, $10,000 and the life of the equipment, 5 years. That's all the data that are entered. You now go back to the executive routine where you will have your choice again selecting from 1, 2, 3, 4 or 5. At this point you decide to look at straightline depreciation. Calling up program Number 1, you jump into the straightline depreciation subroutine and you are prompted by "years?". Entering 1 will give you the first year's depreciation. When the program has finished and given you the straightline depreciation data for that year, you then return to the straightline depreciation subroutine again, and have your choice of entering different "years?" to evaluate the depreciation over a different period of time. If you're finished with your evaluation of straightline depreciation, you merely enter "years?" as zero, and the microprocessor then returns to the executive routine, displaying 1, 2, 3, 4 or 5. At this point you may enter new data or you may examine sum of the year's digits, variable rate declining balance, or the crossover point for the data that were entered already in operation Number 5.

Share in the tax write-off advantages of big business. They are available for you too — and you don't necessarily need a hefty data base.

BASIC PROGRAM DESCRIPTION

Figure 2 is a more detailed block diagram of the routines that take place within the processor. Subroutine 1000 performs homeup and erase of the screen on my CT1024 terminal. It may have to be written as a subroutine which will feed out 16 line feeds to clear the screen of your CRT, depending on the type of data display you have. The next routine is the print data routine. Next "input selection" takes place. This is where you choose which one of the depreciation schedule and analysis operations you wish to take place. Note that steps 1, 2, 3, 4 and 5 all have their own subroutines. These subroutines all return to the same place, which is called the data display subroutine. (All, that is, except Number 5 which returns to the main routine). The "enter" subroutine is the subroutine which

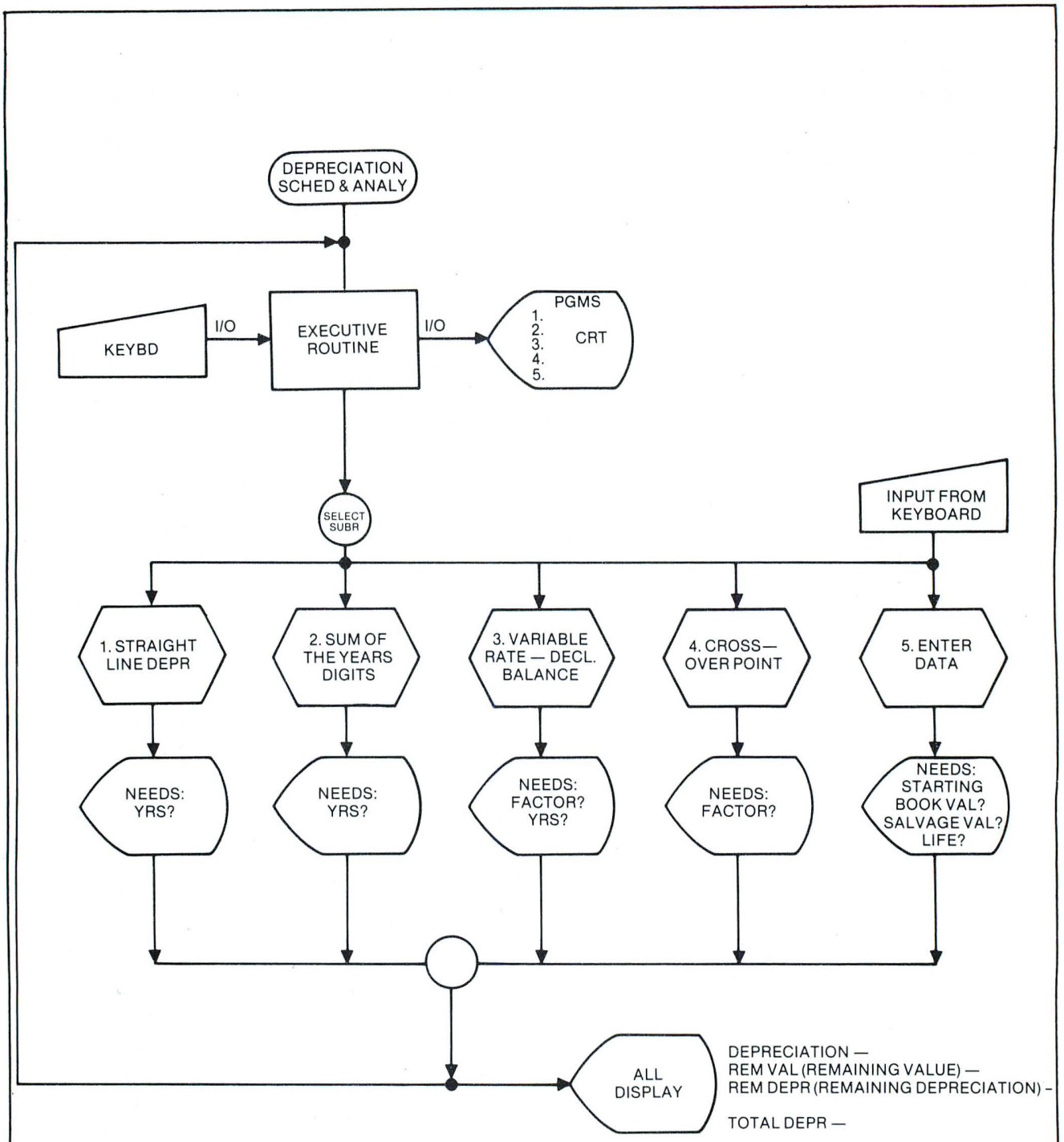

Figure 1. Gross System Operating Flowchart. The executive routine is actually the only routine, all others are subroutines that are called from the executive routine. This flowchart shows I/O demands and prompts from all routines and subroutines.

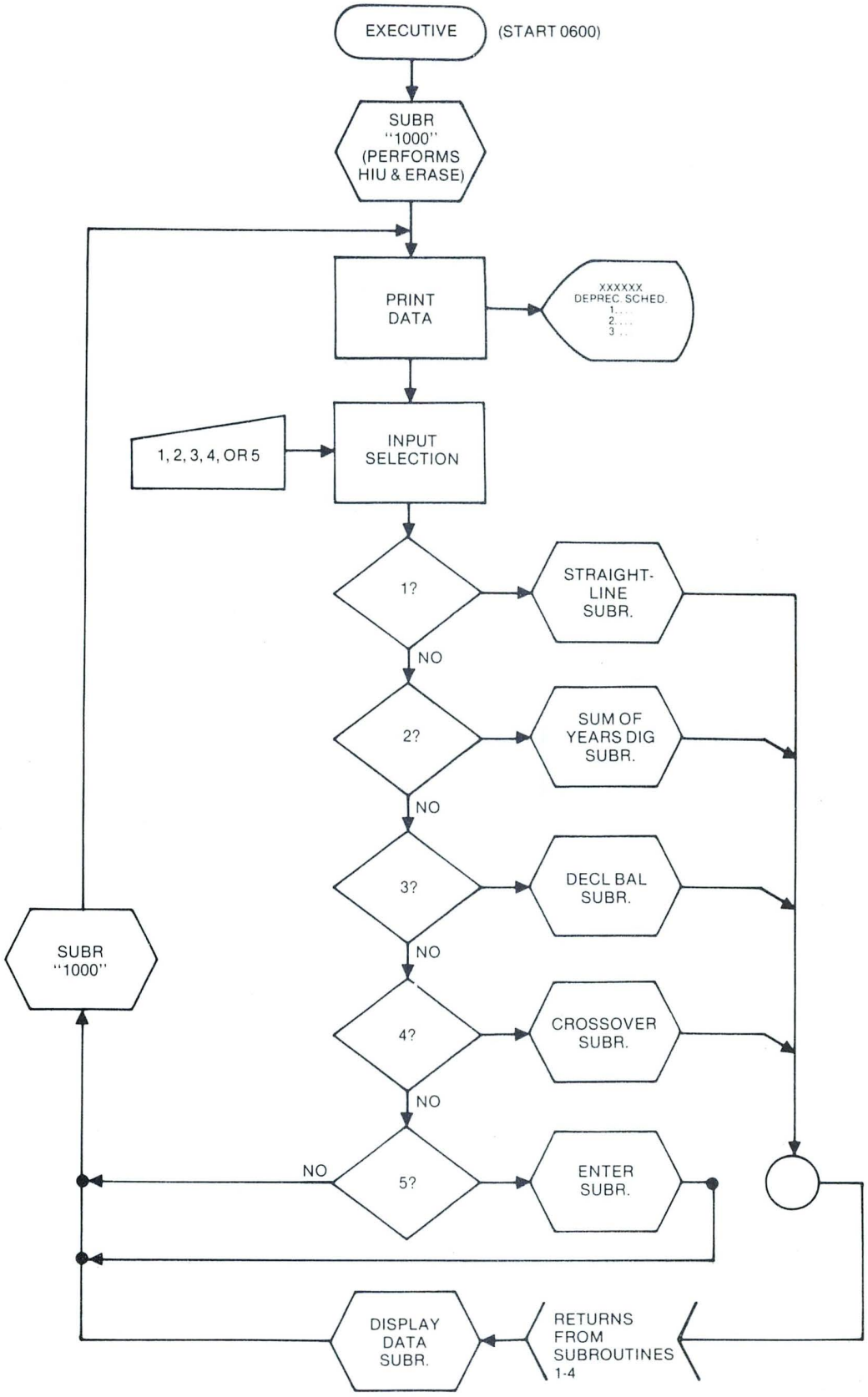

Figure 2. Executive Routine Flowchart

Straight Line

Depreciation = (BV-Sal)/Life
TOT DEPR = (Year of Sched)*(Depreciation)
REM DEPR = (Life - Year of Sched) (Depreciation)
REM VAL = REM DEPR + Salvage Value

Sum of the Year's Digits

F = Absolute Value of [(Int Life) - Life]
I = Int (Life)

$$X = \frac{(I + 1)(I + 2F)}{2}$$

$$\text{Depreciation} = \left(\frac{\text{Life} + 1\text{-yr.}}{X}\right) \text{(Start. book value-SAL value)}$$

$$TI = \frac{(\text{I-year} + 1)(I - \text{year} + 2F)}{ZX}$$

TOT DEPR = (I - TI)(Book - Salvage)
REM DEPR = TI (Book - Salvage)
REM VAL = REM DEPR + Salvage

Variable Rate — Declining Balance

$$X = \frac{\text{Factor}}{\text{Life}}$$

Depreciation = Book Value [(I-X)(year-1)]•X
TOT DEPR = Book Value (I-(I-X)y)
REM DEPR = (Book Value - Salvage) — Total Depr
REM VAL = REM DEPR + Salvage

Crossover Point

$$X = \frac{\text{Factor}}{\text{Life}} \qquad XI = I\text{-}X$$

$$G = \left(\frac{\text{I-X, year-1}}{X_1\text{-I}}\right)$$

[(Book Value•Salvage Value) + (Book-Sal.)]•X

$$P = \frac{G}{1 + (\text{Life-year})}$$

$$O = \left(X, (\text{year-1})\right) \text{(Book Value)(X)}$$

Year is value where P ≥ 0
Rem Book Value = G + Salvage
Rem Years = Life-year

Figure 3

has the job of assigning values to the variables whose values you enter as previously discussed.

Figure 3 gives the mathematical formulae that are used in each one of the subroutines, broken out into subroutines so that you'll understand what is going on in the program proper. At this time, an explanation of the program listing is in order, and we should begin by examining Step 1000. Step 1000 contains Subroutine 1000, which is a Print Control P followed by Control V. These are the homeup and erase the screen commands for my CT1024 terminal. Your subroutine 1000 might consist of FOR N = 1 TO 16 PRINT (Line Feed), NEXT N, then RETurn. This would give 16-line feeds to clear the screen in a CRT display unit where the cursor was on the lower left-hand side of the screen rather than the upper left-hand side, as it is in the CT1024, (in other words, a scrolling display). At Step 40 you have data entry. This is, again, called as a subroutine, so this would be Subroutine 40. Notice the prompting. You are to input starting book value, which is assigned to variable B; the salvage value, which is assigned to variable S; and the life of the item, which is assigned to variable L. The mathematics in Step 110 are merely a preliminary step to get the "F" function which is used in the sum of the year's digits depreciation calculations. The command at Step 95 may not be available in your particular BASIC. Digits = 2 is the number of digits that the answers will be rounded off to in SWTPC 8K BASIC.

You may have a command that is similar to this, or you may not have this facility at all, and thus, decimal fractions will be carried out to some fraction of a cent. This won't hurt the operation of the program, it will

TABLE 1.

REM VAL	=	Remaining Value
REM DEPR	=	Remaining Depreciation
TOT DEPR	=	Depreciation to Date
YEARS?		When the schedule starts, must be whole number, or causes error in calculation.
LIFE		Fractional value are O.K. here, but must be entered as decimal. i.e., 5.5 years.

1. All fractional years entered as decimal, i.e., 12 years 3 months equals 12.25.
2. You can depreciate below the salvage value.
3. Note that the variable rate declining balance still has a lot of depreciated value left at the end of the schedule. Use the crossover program (operation 4 to determine best time to convert from variable rate to straight line). The crossover is determined as outlined in IRS publication 534. Use the year indicated as the last year in the variable rate declining balance, then use straightline depreciation for the rest of the balance. The REM VAL is entered as the starting book value. The Remaining Life is entered for LIFE. The salvage value will be the same as the original. Total depreciation to date will be wrong by the amount depreciated in the other program.

merely look confusing. Subroutine 120 is the straightline depreciation program. You're called upon to input years which are given to variable Y. Note the use of Step 128, if Y = 0, then return. This is how you exit the straightline depreciation program. Otherwise, you may evaluate the straightline depreciation of a given item over several years of its life. At Step 145, note the call to Subroutine 150. The subroutine at 150 is the printout subroutine, so you print out the given values of straightline depreciation. At Step 147, after returning from the printout subroutine, you then go to 125 which re-figures straightline depreciation for any other year input. At that time, you have the option of exiting the straightline depreciation program and going back to the executive routine by entering a zero for the number of years.

Step 150 is the printout subroutine. It very simply prints depreciation D, remaining value Q, remaining depreciation R. One could use any string explanations that one feels are necessary at this point. That is, it might be possible to write out "REMAINING DEPRECIATION" rather than abbreviating as is done in this program listing. The return from Subroutine 150 is Step 165.

Step 200 is the subroutine which determines the sum of the year's digits. Here you input the years that you're evaluating this subroutine for. The subroutine is rather straight forward. Notice the call of Subroutine 150 (printout data subroutine) at Step 290. Note also that inputting years = 0 (see Step 235) will take you out of the sum of the years digits routine and return you to the executive routine.

Step 350, variable rate declining balance; here you must not only enter years, but a factor N. This program uses factor rather than percent declining balance. Thus, a 1.5 declining balance factor and a 150% declining balance are the same thing. Be sure to make all entries as whole numbers between 1 and 2. The trusty Y = 0 escape for variable rate declining balance is located at Step 382. Notice at Step 385 the calculating printout. Because Southwest Technical Product's 8K BASIC takes so long to do exponential mathematics and there are exponential mathematics involved in the variable rate declining program, it was felt necessary to put a step in here that would tell you when the terminal was calculating the correct answer rather than make you think the processor had gone idle for this amount of time, possibly causing you to input data or panic and hit the reset switch. This may be eliminated where the BASIC is faster.

The executive routine is located at Step 600. The executive routine merely prints out depreciation schedule and analysis, allows you to choose your operation 1 through 5, and then sends you to whatever subroutine is called upon. Note in Step 715, before you are sent to a given subroutine you are sent to Subroutine 1000 where the screen is cleared of data. At Step 720 the "ON" BASIC command is used. If your particular BASIC does not have an "ON" command, you will have to run through a table if C = 1, GOSUB 120; if C = 2, GOSUB 200, etc. Notice at Step 730 after subroutines 1 through 4 have been performed, you are then sent back to Subroutine 1000 to clear the screen again. Then the executive routine loops back on itself to Step 630. To exit the executive routine you may choose Operation 6 or any operation higher than 5. You will get an error readout. Or, you may use the familiar old CTL C button on the microprocessor control terminal.

Finally, at Step 800, the crossover point subroutine has only a factor input. You input a given factor, and the processor automatically increments the years from year = 0 up (see Steps 830 and 832). At Step 835, we print calculating again, then we go through the mathematics looking for a match at Step 892. If we do not have a match, that is P > 0, then we go back to Step 832, increment the years again, and continue printing "CALCULATING..." and going through the mathematical calculations. Again, if your processor is very fast, you may not need Step 835 — you will need all the others, however. In Step 895, once the proper year has been found, it is decremented; then at 900 the crossover readout is given, with a limited printout consisting of remaining book value and remaining years. It was a disadvantage to jump into the print subroutine at 150 at this point and print partial data out, so it was done here in the crossover point subroutine. Steps 910 and 920 determine whether or not the crossover point will loop back and allow you to evaluate the same data with a different factor, or whether you return from the crossover point subroutine back to the executive routine.

Finally, Table 1 is given with various operating parameters outlined and each of the printouts shown. Once the program is in your microprocessor, I suggest that you try various depreciation values to get a feel for how the program works. Once you have run through a couple of depreciations this will become one of the handiest microbusiness programs you've ever had.

COMPUTER TERMINAL INTERFACE

```
#RUN
   **********************************

DEPRECIATION SCHEDULE ANALYSIS
CHOOSE OPERATION
  1. STRAIGHT LINE
  2. SUM OF YRS DIGITS
  3. VAR RATE DECL BAL
  4. CALC CROSOVER POINT
  5. ENTER DATA
?5
(HOMEUP/ERASE)
STARTING BOOK VALUE?30,000
SALVAGE VALUE?5,000
LIFE?10
(HOMEUP/ERASE)
   **********************************

DEPRECIATION SCHEDULE ANALYSIS
CHOOSE OPERATION
  1. STRAIGHT LINE
  2. SUM OF YRS DIGITS
  3. VAR RATE DECL BAL
  4. CALC CROSOVR POINT
  5. ENTER DATA
?1
(HOMEUP/ERASE)
YEARS?1
DEPRECIATION          2500
REM VAL              27500
REM DEPR             22500
TOT DEPR              2500
YEARS?8
DEPRECIATION          2500
REM VAL              10000
REM DEPR              5000
TOT DEPR             20000
YEARS?0

   ************
   EXECUTIVE
   BLURB

?2
(HOMEUP/ERASE)
YEARS?1
DEPRECIATION          4545.45
REM VAL              25454.55
REM DEPR             20454.55
TOT DEPR              4545.45
YEARS?7
DEPRECIATION          1818.18
REM VAL               7727.27
REM DEPR              2727.27
TOT DEPR             22272.73
YEARS?0

   ************
   EXECUTIVE
   BLURB

?3
FACTOR?1.5
YEARS?1
                    CALCULATING
DEPRECIATION          4500
REM VAL              25500
REM DEPR             20500
TOT DEPR              4500
FACTOR?1.5
YEARS?0

   ************
   EXECUTIVE
   BLURB

?4
FACTOR?1.5
CALCULATING . . . . CALCULATING . .
. . CALCULATING . . . . CALCULATING
. . . . CALCULATING . . . . CALCULATING
. . . . CALCULATING . . . . CALCULATING
CROSSOVER AT 7 YEARS
FINISHED?Y
   **********************************

DEPRECIATION SCHEDULING & ANALYSIS
CHOOSE OPERATION
  1. STRAIGHT LINE
  2. SUM OF YRS DIGITS
  3. VAR RATE DECL BAL
  4. CALC CROSOVR POINT
  5. ENTER DATA
```

Figure 4.

PROGRAM BASIC LISTING

```
0010 REM ***DEPRECIATION***
0020 REM WRITTEN BY JR HUFFMAN
0030 REM JAN 11,1976
0035 GOTO 600

0040 REM DATA ENTRY ********
0045 REM
0050 INPUT "STARTING BOOK VALUE",B
0060 INPUT "SALVAGE VALUE",S
0070 INPUT "LIFE",L
0080 LET D=(B-S)/L
0090 PRINT
0095 DIGITS= 2
0110 LET F=ABS(INT(L)-L)
0115 RETURN

0120 REM *****STRAIGHTLINE
0125  D=(B-S)/L
0127 INPUT "YEARS",Y
0128 IF Y=0 THEN RETURN
0130  T=Y*D
0140  R=(L-Y)*D
0142  Q=R+S
0145 GOSUB 150
0147 GOTO 125
0150 REM SUBR

0151 REM ****PRINTOUT
0152 PRINT "DEPRECIATION ";D
0153 PRINT TAB(4);"REM VAL ";Q
0155 PRINT TAB(3);"REM DEPR ";R
0157 PRINT
0160 PRINT "TOT DEPR ";T
0165 RETURN

0200 REM ****SUM OF YEARS DIGITS
0210  I=INT(L)
0220  X=((I+1)*(I+2*F))/2
0230 INPUT "YEARS ",Y
0235 IF Y=0 THEN RETURN
0240  D=((L+1-Y)/X)*(B-S)
```

```
0250  T1=((I-Y+1)*(I-Y+2*F))/(2*X)
0260  T=(1-T1)*(B-S)
0270  R=T1*(B-S)
0280  Q=R+S
0290 GOSUB 150
0300 GOTO 230

0350 REM **VARIABLE RATE -DEC BAL
0360 REM
0370 INPUT "FACTOR",N
0380 INPUT "YEARS",Y
0382 IF Y=0 THEN RETURN
0385 PRINT TAB(8);"CALCULATING"
0390  X=N/L
0400  D=B*((1-X)↑(Y-1))*X
0420  T=B*(1-((1-X)↑Y))
0430  R=(B-S)-T
0440  Q=R+S
0450 GOSUB 150
0460 GOTO 350
0600 REM EXEC ROUTINE
0610 REM
0620 GOSUB 1000
0630 PRINT TAB(8);"**********"
0640 PRINT "  DEPRECIATION  SHEDULING &
ANALYSIS"
0650 PRINT
0660 PRINT
0670 PRINT "CHOOSE OPERATION"
0680 PRINT
0690 PRINT "    1. STRAIGHT LINE"
0692 PRINT "    2. SUM OF YRS DIGITS"
0694 PRINT "    3. VAR RATE DECL BAL"
0696 PRINT "    4. CALC CROSOVR POINT"
0700 PRINT "    5. ENTER DATA"
0710 INPUT C
0715 GOSUB 1000
0720 ON C GOSUB 120,200,350,800,40
0730 GOSUB 1000
0740 GOTO 630


0800 REM ***CROSSOVER POINT
0810 REM
0820 INPUT "FACTOR",N
0830 LET Y=0
0832 LET Y=Y+1
0835 PRINT "CALCULATING......."
0840  X=N/L
0850  X1=1-X
0860  G=(1-(X1↑(Y-1)))/(X1-1)
0870  G=(G*B*X)+B-S
0880  P=G/(1+(L-Y))
0890  D=(X1↑(Y-1))*B*X
0892 IF P<0 THEN 832
0895  Y=Y-1
0900 PRINT "CROSSOVER  AT ";Y;" YEARS"
0902 PRINT
0903 PRINT "REMAINING B VAL = ";G+S
0904 PRINT "REMAINING YEARS = ";L-Y
0905 PRINT
0907 IF A$="N" THEN 820
0910 INPUT "FINISHED",A$
0920 IF A$="N" THEN  820
0930 RETURN

1000 PRINT ""
1010 RETURN
```

SYSTEM SPECIALS

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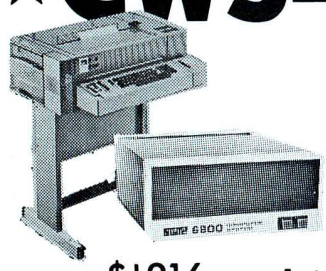

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CIRCLE INQUIRY NO. 83

8080/Z-80 I/O DRIVER PROGRAM FOR THE PERSCI 1070 INTELLIGENT DISKETTE CONTROLLER — PERSCI80

by Michael D. Busch

INTRODUCTION

This program is a minimal driver routine which interfaces the PerSci Model 1070 Intelligent Diskette Controller (described in another article in this issue) with an 8080- or Z-80-based microcomputer. The driver permits you to talk directly to the PerSci controller from the microcomputer console, using the full repertoire of file management commands supported by the 1070. The driver also supports high-speed transfer of disc files into and out of microcomputer RAM.

The driver is written to access the status and data bytes of the PerSci controller using a pair of I/O ports (HEX C0 and C1 in the assembly listing), but it may be easily modified to use memory-mapped I/O simply by replacing the IN and OUT instructions in subroutines DINP, DOUT, DOUTC, and DOUTW with appropriate LDA and STA instructions.

The driver is coded using the 8080 instruction set, and will also run on a Z-80 without modification. If you are using a Z-80, however, the size of the driver may be reduced substantially by replacing most of the 3-byte jump instructions with 2-byte relative jumps supported in the extended Z-80 instruction set. The flowcharts and the heavily-commented assembly listing gives a detailed description of how the driver works.

APPLICATION

Although the driver is presented in this article as a stand-alone program, it is perhaps most useful as a guide to interfacing the PerSci 1070 Controller to your favorite non-disc operating system (ESP-1, AMSAT, D&M, ZAPPLE, or what have you). The resulting software has all of the capabilities of a disc operating system (such as CP/M or FDOS), but remains fully compatible with all of the software which you have developed during the dark ages before you acquired your disc system.

One easy way to do this is to pick a command prefix letter which is not used by your operating system (let us say "F" for "floppy," for example). Patch the command branch table in your operating system so that commands starting with that prefix letter cause control to be transferred to the disc driver program; all other commands are processed normally by your operating system. Set up the disc driver program (subroutine DLINE) so that all characters of the command following the prefix letter are sent to the controller. Also change the disc driver (routine DCTRL) so that control is returned to the operating system when an "EOT" is received from the disc controller, and to your delight you have an honest-to-goodness disc operating system. Since most of the utility subroutines which appear in Section 2 of the disc driver assembly listing are already contained in your operating system in some form, adding disc capability in this manner should increase the size of your operating system resident by less than 200 bytes. I've done it with ESP-1, ZAPPLE, and a homebrew monitor, and it works superbly.

[Note: the operating systems CP/M, FDOS, and ZAPPLE are copyrighted by Digital Research, iCOM, and TDL, respectively.]

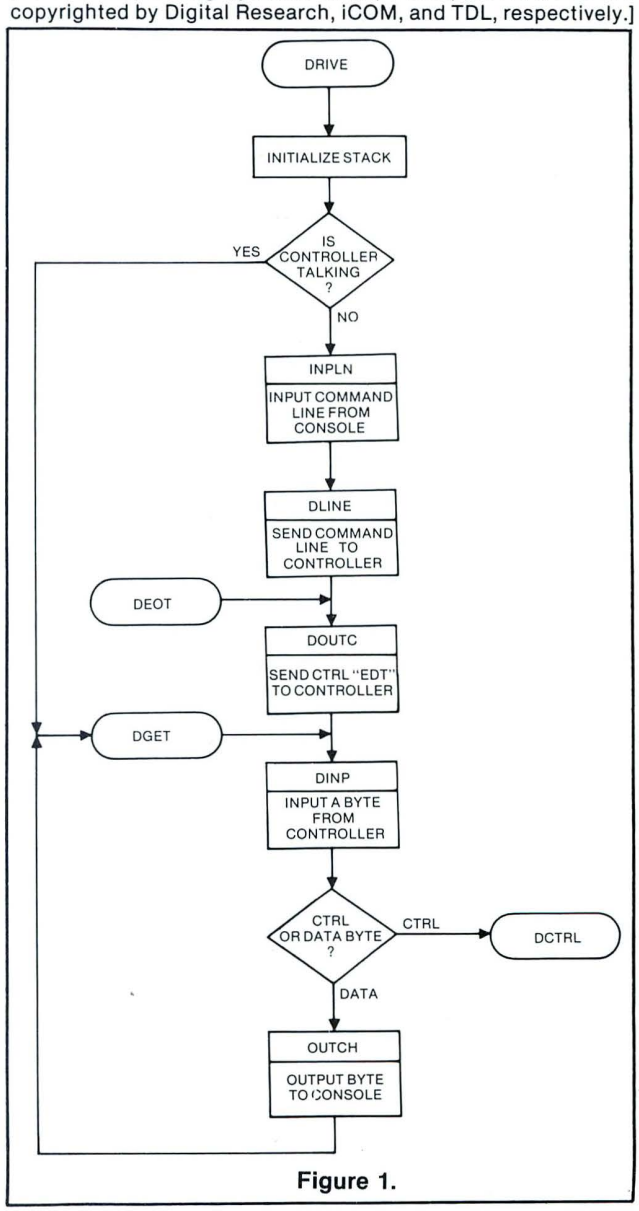

Figure 1.

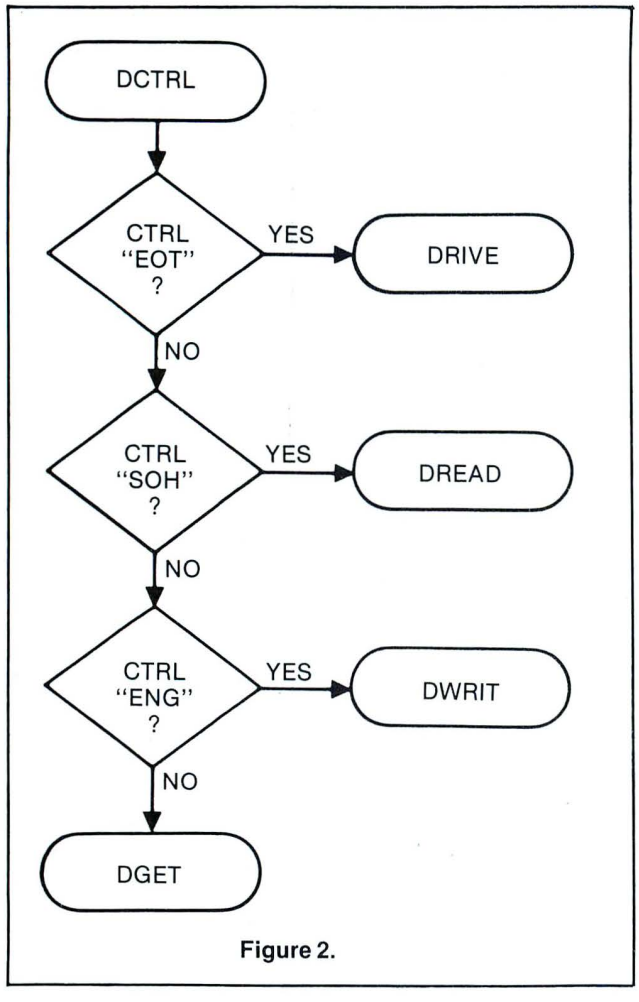

Figure 2.

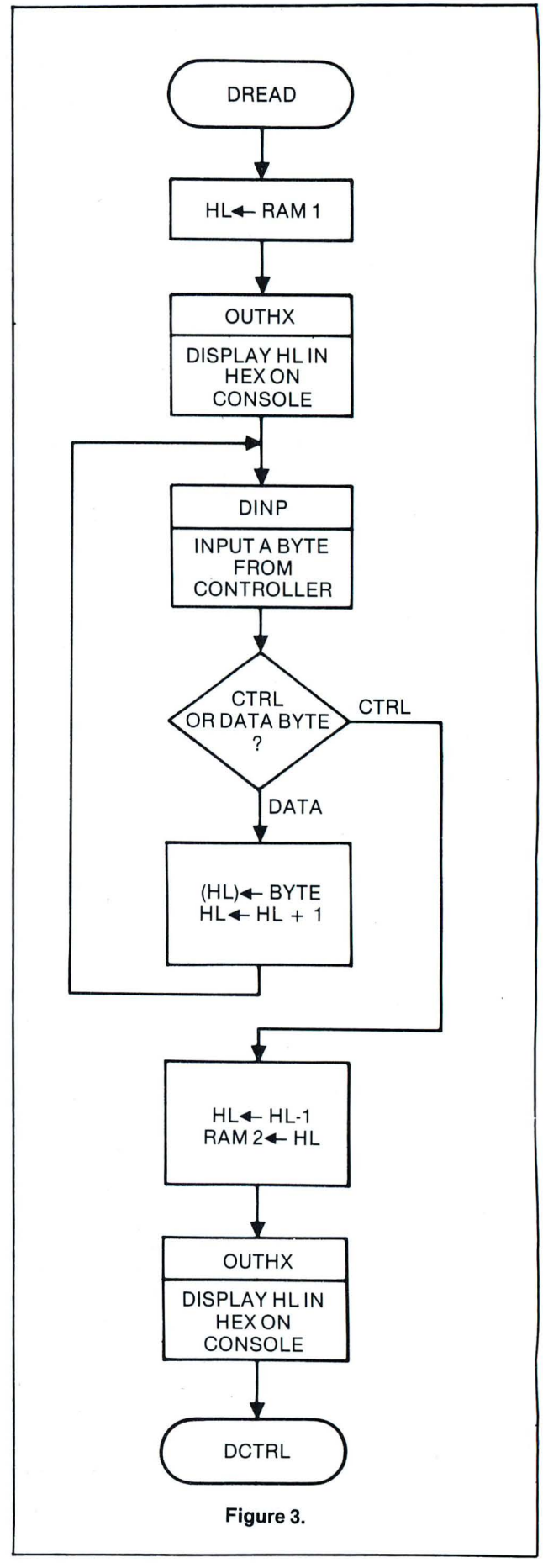

Figure 3.

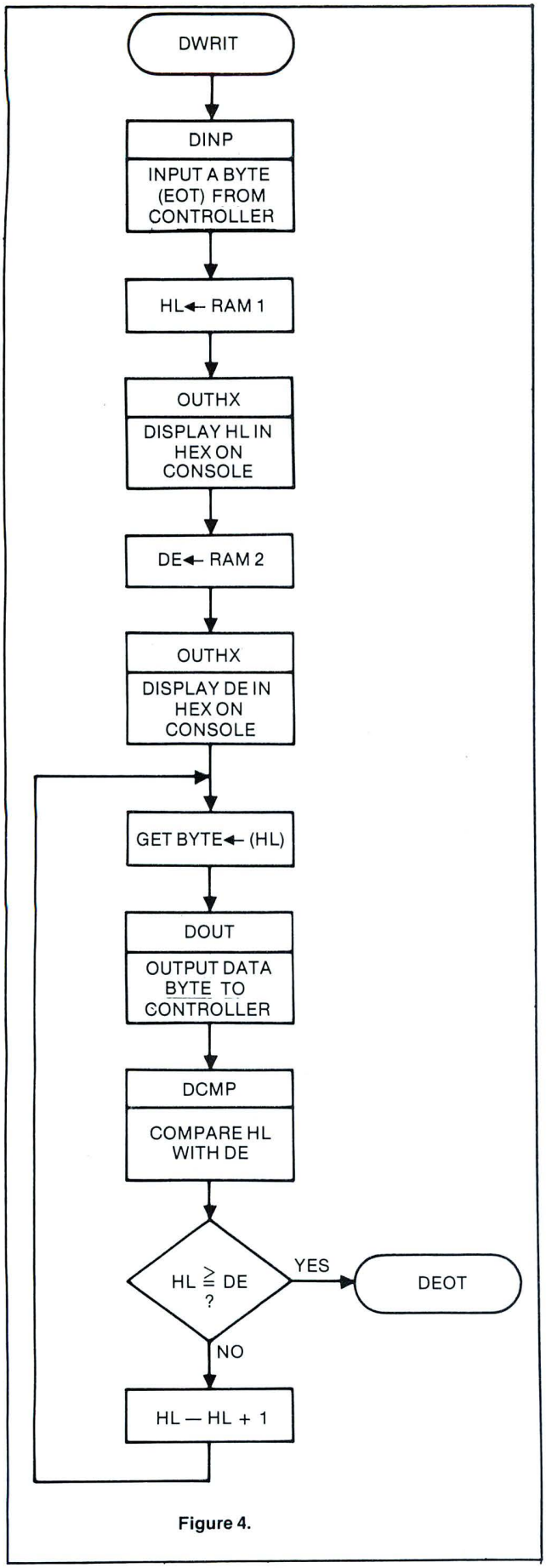

Figure 4.

PROGRAM LISTING

```
.TITLE "Sample Driver Program for PerSci 1070 Controller"
.LOC    0000    ;ASSEMBLY ORIGIN
.PABS           ;ABSOLUTE ASSEMBLY
.I8080          ;I-8080 INSTRUCTION SET ONLY
.LALIN          ;LIST ADDRESSES LSB FIRST
;
; This program operates on an 8080-based microcomputer.
; It assumes that the PerSci Model 1070 controller is
; interfaced via its parallel interface in such a manner
; that its data and status ports appear to the 8080 as
; I/O ports C0 and C1 (hex), respectively.  It also as-
; sumes that an ASCII console device (teletypewriter or
; keyboard/CRT) is connected to the microcomputer.
;
; This program listing is divided into two sections.
; section 1 contains those routines which are unique to
; the PerSci controller interface.  It requires only
; 166 bytes of program storage and 4 bytes of RAM.
;
; Section 2 contains general I/O subroutines which are
; routinely a part of most microcomputer operating sys-
; tems or monitors, and thus which will not need to be
; duplicated in most installations.
.PAGE
                .SBTTL "Section 1 - Controller Interface Routines"
                ;
                ;
                ; This is the basic driver routine which sends console
                ; commands to the controller, controller messages to
                ; the console, and controls the transmission of files
                ; and records between the controller and microcomputer
                ; RAM.
                ;
0000  319B01    DRIVE:  LXI     SP,STACK        ;INITIALIZE STACK
0003  DBC1              IN      DSTAT   ;GET DISK STATUS
0005  E6C0              ANI     0C0H    ;IS DISK TALKING?
0007  C21500            JNZ     DGET    ;IF SO, LISTEN FIRST
000A  CDAA00            CALL    INPLN   ;INPUT CONSOLE LINE
000D  CD7200            CALL    DLINE   ;SEND COMMAND TO DISK
0010  3E04      DEOT:   MVI     A,EOT   ;SEND "EOT" TO DISK
0012  CD6D00            CALL    DOUTC   ;AS CONTROL BYTE
0015  CD7C00    DGET:   CALL    DINP    ;INPUT BYTE FROM DISK
0018  DA2100            JC      DCTRL   ;CONTROL OR DATA BYTE?
001B  CD4C01            CALL    OUTCH   ;DATA, SEND TO CONSOLE
001E  C31500            JMP     DGET
0021  FE04      DCTRL:  CPI     EOT     ;CONTROL, WHAT KIND?
0023  CA0000            JZ      DRIVE   ;"EOT", COMMAND IS DONE
0026  FE01              CPI     SOH
0028  CA3300            JZ      DREAD   ;"SOH", DO DISK READ
002B  FE05              CPI     ENQ
002D  CA5000            JZ      DWRIT   ;"ENQ", DO DISK WRITE
0030  C31500            JMP     DGET    ;ELSE IGNORE (ERROR)
                ;
                ;
                ; This routine controls a disk read into RAM.
                ;
0033  2AA600    DREAD:  LHLD    RAM1    ;GET RAM STARTING ADDR
0036  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
0039  CD7C00    DREAL:  CALL    DINP    ;INPUT BYTE FROM DISK
003C  DA4400            JC      DREAX   ;CONTROL OR DATA BYTE?
003F  77                MOV     M,A     ;DATA, MOVE TO RAM
0040  23                INX     H       ;INCREMENT RAM ADDR
0041  C33900            JMP     DREAL   ;NEXT BYTE
0044  F5        DREAX:  PUSH    PSW     ;CONTROL, SAVE BYTE
0045  2b                DCX     H       ;DECREMENT RAM ADDR
0046  22A600            SHLD    RAM2    ;SAVE RAM ENDING ADDR
0049  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
004C  F1                POP     PSW     ;GET CONTROL BYTE
004D  C32100            JMP     DCTRL   ;GO ANALYZE IT
                ;
                ;
                ; This routine controls a disk write from RAM.
                ;
0050  CD7C00    DWRIT:  CALL    DINP    ;INPUT BYTE FROM DISK
0053  D25000            JNC     DWRIT   ;SHOULD BE AN "EOT"
0056  2AA600            LHLD    RAM1    ;GET RAM STARTING ADDR
0059  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
005C  EB                XCHG
005D  2AA800            LHLD    RAM2    ;GET RAM ENDING ADDR
0060  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
0063  EB                XCHG            ;START IN HL, END IN DE
0064  7E      DWRIL:  MOV     A,M     ;GET BYTE FROM RAM
0065  CD6700            CALL    DOUT    ;SEND DATA TO DISK
0068  CD3C01            CALL    DCMP    ;COMPARE ADDR TO END
006B  D21000            JNC     DEOT    ;AT END, SEND "EOT"
006E  23                INX     H       ;ELSE INCREMENT RAM ADDR
006F  C36400            JMP     DWRIL   ;PROCESS NEXT BYTE
                ;
                ;
                ; This routine sends a command to the controller.
                ;
0072  CD2601    DLINE:  CALL    GETCH   ;GET CHAR FROM BUFFER
0075  D8                RC              ;EXHAUSTED, ALL DONE
0076  CD8700            CALL    DOUT    ;SEND CHARACTER TO DISK
0079  C37200            JMP     DLINE   ;PROCESS NEXT CHARACTER
                ;
                ;
                ; This routine inputs a byte from the controller
                ; and sets the carry flag if it is a control byte.
                ;
007C  DBC1      DINP:   IN      DSTAT   ;GET DISK STATUS BYTE
007E  E6C0              ANI     0C0H    ;RECEIVE DATA AVAILABLE?
0080  CA7C00            JZ      DINP    ;NO, WAIT UNTIL IT IS
0083  17                RAL             ;SET CARRY IF CONTROL
0084  DBC0              IN      DDATA   ;GET DISK DATA BYTE
0086  C9                RET             ;ALL DONE
                ;
                ;
                ; This routine outputs a data byte to the controller.
                ;
0087  CD9500    DOUT:   CALL    DOUTW   ;WAIT UNTIL READY
008A  D3C0              OUT     DDATA   ;WRITE DISK DATA BYTE
008C  C9                RET             ;ALL DONE
                ;
                ;
                ; This routine outputs a control byte to the controller.
```

```
                        ;
008D  CD9500    DOUTC:  CALL    DOUTW   ;WAIT UNTIL READY
0090  D3C1              OUT     DSTAT   ;WRITE DISK STATUS BYTE
0092  D3C0              OUT     DDATA   ;WRITE DISK DATA BYTE
0094  C9                RET             ;ALL DONE
                        ;
                        ;
                        ; This routine waits for the disk transmit buffer to be
                        ; empty and ready for another byte.  It also arbitrates
                        ; if disk and host try to transmit to one another at
                        ; the same time.
                        ;
0095  F5        DOUTW:  PUSH    PSW     ;SAVE BYTE TO SEND
0096  DBC1              IN      DSTAT   ;GET DISK STATUS BYTE
0098  E6C0              ANI     0C0H    ;IS DISK TRANSMITTING?
009A  C2A400            JNZ     DOUTX   ;YES, BREAK THE TIE
009D  DBC1              IN      DSTAT   ;GET DISK STATUS AGAIN
009F  E603              ANI     03H     ;IS TRNSMT BUFFER EMPTY?
00A1  C29600            JNZ     DOUTW+1 ;NO, WAIT UNTIL IT IS
00A4  F1        DOUTX:  POP     PSW     ;RESTORE BYTE TO SEND
00A5  C9                RET             ;ALL DONE
                        ;
                        ;
                        ; Symbolic Equivalences
                        ;
00C0                    DDATA   = 0C0H  ;CONTROLLER DATA PORT
00C1                    DSTAT   = 0C1H  ;CONTROLLER STATUS PORT
0004                    EOT     = 04H   ;ASCII "EOT"
0001                    SOH     = 01H   ;ASCII "SOH"
0005                    ENQ     = 05H   ;ASCII "ENQ"
                        ;
                        ;
                        ; RAM Working Storage
00A6  0000              RAM1:   .WORD   0       ;SAVE/LOAD START ADDR
00A8  0000              RAM2:   .WORD   0       ;SAVE/LOAD END ADDR
                        ;
                        ;
                        .PAGE
                        .SBTTL "Section 2 - Common Subroutines"
                        ;
                        ;
                        ; This routine inputs a line from the console device
                        ; into a RAM buffer, and processes backspace and
                        ; line-delete functions.
                        ;
00AA  CDFA00    INPLN:  CALL    CRLF    ;CR/LF TO CONSOLE
00AD  3E3E              MVI     A,'>'   ;GET COMMAND PROMPT
00AF  CD4C01            CALL    OUTCH   ;SEND TO CONSOLE
00B2  21B001            LXI     H,IBUFF ;GET BUFFER ADDRESS
00B5  22B001            SHLD    IBUFP   ;INITIALIZE POINTER
00B8  0E00              MVI     C,0     ;INITIALIZE COUNT
00BA  CD4201    INPLI:  CALL    INPCH   ;GET CHAR FROM CONSOLE
00BD  E67F              ANI     7FH     ;STRIP PARITY BIT
00BF  FE20              CPI     ' '     ;TEST IF CONTROL CHAR
00C1  DAD400            JC      INPLC   ;YES, GO PROCESS
00C4  77                MOV     M,A     ;NO, PUT IN BUFFER
00C5  3E20              MVI     A,32    ;GET BUFFER SIZE
00C7  B9                CMP     C       ;TEST IF FULL
00C8  CABA00            JZ      INPLI   ;YES, LOOP
00CB  7E                MOV     A,M     ;RECALL CHARACTER
00CC  23                INX     H       ;INCR POINTER
```

```
00CD  0C          INR     C       ;AND INCR COUNT
00CE  CD4C01  INPLE:  CALL    OUTCH   ;ECHO CHARACTER
00D1  C3BA00          JMP     INPLI   ;GET NEXT CHAR
00D4  FE08    INPLC:  CPI     08H     ;TEST IF BACKSPACE
00D6  CAEB00          JZ      INPLB   ;YES, KILL CHAR
00D9  FE1B            CPI     1BH     ;TEST IF ESCAPE
00DB  CAF500          JZ      INPLK   ;YES, KILL LINE
00DE  FE0D            CPI     0DH     ;TEST IF RETURN
00E0  C2BA00          JNZ     INPLI   ;NO, IGNORE CHAR
00E3  79              MOV     A,C     ;GET COUNT
00E4  327A01          STA     IBUFC   ;SAVE IT
00E7  CDFA00          CALL    CRLF    ;SEND CR/LF TO CONSOLE
00EA  C9              RET             ;DONE
00EB  2B      INPLB:  DCX     H       ;DECREMENT POINTER
00EC  0D              DCR     C       ;DECREMENT COUNT
00ED  F2CE00          JP      INPLE   ;IF NOT NEG, GO ECHO
00F0  23              INX     H       ;IF NEG, UNDO DECR
00F1  0C              INR     C
00F2  C3BA00          JMP     INPLI   ;GET NEXT CHAR
00F5  AF      INPLK:  XRA     A       ;KILL BY SETTING
00F6  327A01          STA     IBUFC   ;COUNT TO ZERO
00F9  C9              RET             ;DONE
                ;
                ;
                ; This routine sends a CR LF sequence to the console.
                ;
00FA  3E0D    CRLF:   MVI     A,0DH   ;GET A CR
00FC  CD4C01          CALL    OUTCH   ;DISPLAY IT
00FF  3E0A            MVI     A,0AH   ;GET A LF
0101  CD4C01          CALL    OUTCH   ;DISPLAY IT
0104  C9              RET             ;DONE
                ;
                ;
                ; This routine outputs the contents of registers H-L
                ; as a four-digit hexadecimal number on the console.
                ;
0105  3E20    OUTHX:  MVI     A,' '   ;GET A SPACE
0107  CD4C01          CALL    OUTCH   ;SEND TO CONSOLE
010A  7C              MOV     A,H     ;GET TOP HALF OF WORD
010B  CD0F01          CALL    OUTH1   ;DISPLAY IN HEX
010E  7D              MOV     A,L     ;SAME WITH BOTTOM HALF
010F  F5      OUTH1:  PUSH    PSW     ;SAVE LOW-ORDER DIG
0110  1F              RAR             ;GET HIGH-ORDER DIG
0111  1F              RAR
0112  1F              RAR
0113  1F              RAR
0114  CD1801          CALL    OUTH    ;DISPLAY HEX DIGIT
0117  F1              POP     PSW     ;GET OTHER DIGIT
0118  E60F  OUTH:    ANI     0FH     ;EXTRACT DIGIT
011A  C630            ADI     '0'     ;ADD ASCII ZONE BITS
011C  FE3A            CPI     '9'+1   ;TEST IF A-F
011E  DA4C01          JC      OUTCH   ;NO, OUTPUT IT
0121  C607            ADI     'A'-'9'-1       ;YES, ADD BIAS FOR A-F
0123  C34C01          JMP     OUTCH   ;OUTPUT IT
                ;
                ;
                ; This routine obtains a character from the RAM buffer
                ; and sets the carry flag if exhausted.
                ;
0126  E5      GETCH:  PUSH    H       ;SAVE REGS
0127  2A7801          LHLD    IBUFP   ;GET POINTER
012A  3A7A01          LDA     IBUFC   ;GET COUNT
012D  D601            SUI     1       ;DECREMENT WITH CARRY
012F  DA3A01          JC      GETCX   ;NO MORE CHARACTERS
0132  327A01          STA     IBUFC   ;REPLACE COUNT
0135  7E              MOV     A,M     ;GET CHARACTER
0136  23              INX     H       ;INCR POINTER
0137  227801          SHLD    IBUFP   ;REPLACE POINTER
013A  E1      GETCX:  POP     H       ;RESTORE REGS
013B  C9              RET             ;DONE (CARRY IF NO CHAR)
                ;
                ;
                ; This routine compares D-E with H-L.
                ;
013C  7C      DCMP:   MOV     A,H     ;GET MOST SIGNIF
013D  BA              CMP     D       ;COMPARE MOST SIGNIF
013E  C0              RNZ             ;NONZERO, DONE
013F  7D              MOV     A,L     ;GET LEAST SIGNIF
0140  BB              CMP     E       ;COMPARE LEAST SIGNIF
0141  C9              RET             ;DONE
                ;
                ;
                ; These routines perform input and output from and to
                ; the console device, passing on character in the A-reg.
                ; They must be coded to work with the particular console
                ; I/O interface arrangement of each microcomputer.  The
                ; two routines must not modify any registers other than
                ; the A-reg.
                ;
0142  DB00    INPCH:  IN      0       ;GET CONSOLE STATUS
0144  E601            ANI     01H     ;RECEIVE DATA AVAILABLE?
0146  C24201          JNZ     INPCH   ;NO, WAIT UNTIL IT IS
0149  DB01            IN      1       ;GET CONSOLE DATA
014B  C9              RET             ;ALL DONE
                ;
014C  F5      OUTCH:  PUSH    PSW     ;SAVE DATA TO BE SENT
014D  DB00            IN      0       ;GET CONSOLE STATUS
014F  E680            ANI     80H     ;TRANSMIT BUFFER EMPTY?
0151  C24D01          JNZ     OUTCH+1 ;NO, WAIT UNTIL IT IS
0154  F1              POP     PSW     ;GET SAVED DATA
0155  D301            OUT     1       ;SEND TO CONSOLE
0157  C9              RET             ;ALL DONE
                ;
                ;
                ; RAM Working Storage
                ;
0158            IBUFF:  .BLKB   32      ;INPUT TEXT BUFFER
0178            IBUFP:  .BLKB   2       ;INPUT POINTER
017A            IBUFC:  .BLKB   1       ;INPUT COUNTER
017B                    .BLKB   32      ;STACK AREA
019B            STACK   = .     ;TOP OF STACK
                ;
                ;
0000                    .END    DRIVE   ;END OF ASSEMBLY
```

```
TDL Z80 RELOCATING ASSEMBLER VERSION 1.2
Sample Driver Program for PerSci 1070 Controller
+++++ SYMBOL TABLE +++++

CRLF   00FA    DCMP   013C    DCTRL  0021    DDATA  00C0
DEOT   0010    DGET   0015    DINP   007C    DLINE  0072
DOUT   0087    DOUTC  006D    DOUTW  0095    DOUTX  00A4
DREAD  0033    DREAL  0039    DREAX  0044    DRIVE  0000
DSTAT  00C1    DWRIL  0064    DWRIT  0050    ENQ    0005
EOT    0004    GETCH  0126    GETCX  013A    IBUFC  017A
IBUFF  0158    IBUFP  0178    INPCH  0142    INPLB  00EB
INPLC  00D4    INPLE  00CE    INPLI  00BA    INPLK  00F5
INPLN  00AA    OUTCH  014C    OUTH   0118    OUTH1  010F
OUTHX  0105    RAM1   00A6    RAM2   00A8    SOH    0001
STACK  019B
```

BUBBLE SORT

by Martin Knight

INTRODUCTION

This program, written in 6800 mnemonic code, does a bubble sort of up to 255 unsigned HEX numbers. In order for it to work properly, the numbers to sort must be between 00 and FF and arranged in an array, whose location is user-determined. Before entering the subroutine, the address of the array MINUS ONE should be placed in locations 0003 and 0004 (H&L respectively) and the number of items to be sorted (02 to FE) should be placed in location 0002.

Since the original array is rearranged and put back in the same locations, the original order of the elements is lost. The subroutine will, however, return to the main program with the array in sorted form, and the values of N, ARRAY (HIGH), and ARRAY (LOW) unchanged.

The program itself takes advantage of the direct mode of addressing, which accounts for most of its brevity. Also used to great advantage is the indexed mode of addressing. This program is somewhat unique for when the indices calculated are to be used, as in TEST or SWAP, they are inserted into the proper locations by the program itself. Thus locations 002F, 0031, 0047, and 004F change values as the program is executed. These four locations are loaded with HEX 00 for purposes of obtaining the HEX tape format. Actually, any value will do, since the proper values are later inserted by the program.

The program will sort signed HEX numbers if the BHI instruction at location 0033 is changed to BGT. The program will then sort signed HEX numbers in the range −128 to +127.

The flowchart shows the logic used in obtaining the sorted list. The numbers in parentheses indicate the lines of code corresponding to those particular blocks. Also attached is a Motorola HEX format tape listing for quick entry into any 6800 machine.

BUBBLE SORT ASSEMBLY LISTING

```
PROGRAM NAME = SORT
LANGUAGE = 6800 MACHINE
LENGTH = 67 BYTES
PROGRAMMER = MARTIN KNIGHT
DATE = FEB. 24, 1977

                * SORTING OF UNSIGNED HEX NUMBERS BETWEEN ØØ AND FF
                * SCRATCH MEMORY ASSIGNED AS FOLLOWS:
                * M(ØØØØ) = I
                * M(ØØØ1) = J
                * M(ØØØ2) = N
                * M(ØØØ3) = ARRAY (HIGH)
                * M(ØØØ4) = ARRAY (LOW)
                * M(ØØØ5) = TEMP
                * SORTED ELEMENTS REPLACED IN ARRAY IN SORTED FORM
                * ORIGINAL ORDER OF ELEMENTS IN ARRAY LOST
                * ENTER SUBROUTINE WITH VALUES FOR N, ARRAY (HIGH)
                * AND ARRAY(LOW) ALREADY IN POSITION
                * ARRAY (H&L) CONTAINS ADDRESS OF ARRAY TO SORT MINUS ONE
                * N CONTAINS NUMBER OF ELEMENTS TO SORT (Ø2 TO FE)

LOC             LABEL     MNEMONIC          CODE       COMMENT

ØØ1Ø            SORT      LDX ARRAY         DE Ø3      ;X points to array
ØØ12                      CLR I             7F ØØ ØØ   ;Clear indices
ØØ15                      CLR J             7F ØØ Ø1   ;
ØØ18            LOOP      INC I             7C ØØ Ø1   ;Bump I pointer
ØØ1B                      LDAA I            96 ØØ      ;Check I=N?
ØØ1D                      CMPA N            91 Ø2      ;
ØØ1F                      BEQ END           27 35      ;Yes, then stop
ØØ21                      STAA J            97 Ø1      ;Let J=I+1
ØØ23                      INC J             7C ØØ Ø1   ;
ØØ26            TEST      LDAA I            96 ØØ      ;Get indices
ØØ28                      LDAB J            D6 Ø1      ;
ØØ2A                      STAA INDEXI       97 2F      ;Store in this prgm.
ØØ2C                      STAB INDEXJ       D7 31      ;
ØØ2E                      LDAA INDEXI,X     A6 ØØ      ;Get elts. I and J
ØØ3Ø                      LDAB INDEXJ,X     E6 ØØ      ;
ØØ32                      CBA               11         ;Test if D(I)  D(J)
ØØ33                      BHI SWAP          22 ØB      ;Switch if yes
ØØ35            UPJ       INC J             7C ØØ Ø1   ;Bump J pointer
ØØ38                      LDAA J            96 Ø1      ;See if J  N
ØØ3A                      CMPA N            91 Ø2      ;
ØØ3C                      BHI LOOP          22 DA      ;Yes, go to LOOP
ØØ3E                      BRA TEST          2Ø E6      ;No, go to TEST
ØØ4Ø            SWAP      STAA TEMP         97 Ø5      ;TEMP=D(I)
ØØ42                      LDAA I            96 ØØ      ;Get index I
ØØ44                      STAA INDEX1       97 47      ;Store in this prgm.
ØØ46                      STAB INDEX1,X     E7 ØØ      ;D(I)=D(J)
ØØ48                      LDAA J            96 Ø1      ;Get index J
ØØ4A                      STAA INDEX2       97 4F      ;Store in this prgm.
ØØ4C                      LDAB TEMP         D6 Ø5      ;D(J)=TEMP
ØØ4E                      STAB INDEX2,X     E7 ØØ      ;
ØØ5Ø                      BRA UPJ           2Ø E3      ;Go to UPJ
ØØ52            END       RTS               39         ; Return
```

BUBBLE SORT OBJECT CODE LISTING

```
S113ØØ1ØDEØ37FØØØØ7FØØØ17CØØØØ96ØØ91Ø2273Ø
S113ØØ2Ø3597Ø17CØØØ196ØØD6Ø1972FD731A6ØØA1
S113ØØ3ØE6ØØ1122ØB7CØØØ196Ø191Ø222DA2ØE6EF
S113ØØ4Ø97Ø596ØØ9747E7ØØ96Ø1974FD6Ø5E7ØØ76
S1Ø6ØØ5Ø2ØE3396DS9
```

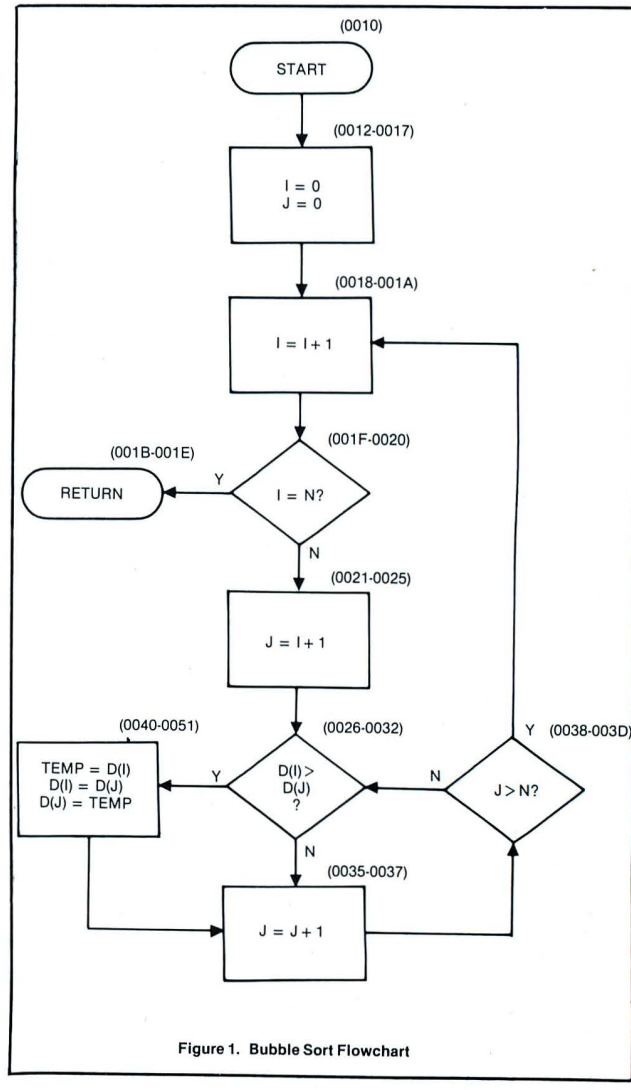

Figure 1. Bubble Sort Flowchart

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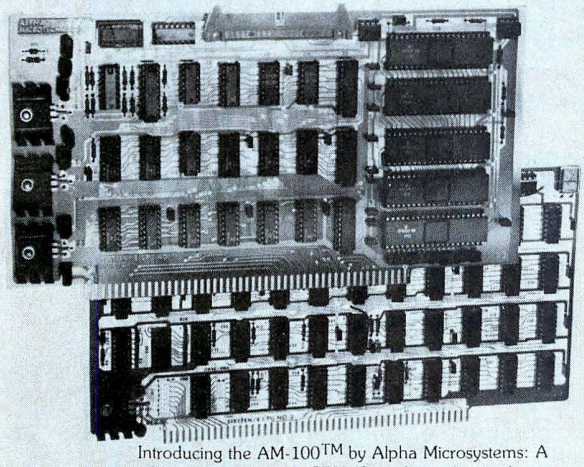

Introducing the AM-100™ by Alpha Microsystems: A 16-bit microprocessor CPU (2-card set) that replaces the 8080 microprocessor in your S-100 bus type computer.

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- System generation program to create custom operating system monitors
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WESTERN DIGITAL MICROPROCESSOR

The AM-100 is based on Western Digital's advanced WD-16 microprocessor chip set. It has been re-microprogrammed to give a more flexible macro instruction set while still maintaining the general architecture and source code format on the popular PDP-11 series.

S-100 BUS COMPATIBILITY

The 16-bit processor system interfaces to the 8-bit S-100 bus by multiplexing through 70-plus TTL logic chips. This multiplexing is totally transparent to the programmer.

ALPHA BASIC COMPILER

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CIRCLE INQUIRY NO. 74

A FASTER TTY PAPER TAPE 6800 LOAD & DUMP PROGRAM

by Jack Johnson

INTRODUCTION

I recently purchased and assembled a SWTPC 6800 computer kit. Except for a few *bone-head* mistakes, the assembly went off without a hitch. I used sockets for easy maintenance, but bent one of the chip pins under when inserting it in the socket. After finding and correcting that problem, the computer worked perfectly. An ASR-33 provides the I/O capability.

After the initial familiarization and playing around process, the long program load time began to wear on my nerves. The SWTPC Resident Assembler loads in 21 minutes. The ASR-33 is inherently a slow device, but an analysis of the paper tape format (Figure 1) as used by the assembler, reveals an incredible overhead. Each Data record required 10 control and 5 NULL frames in addition to the 2 frames per data byte. The assembler formats a maximum of 27 bytes per Data record. Considering that 69 frames are used in specifying the maximum record, the overhead is 42 frames or 156%. I hasten to add that this format is more or less an industry standard and not a creation of SWTPC. The 4K BASIC as supplied by SWTPC is in binary format, but duplication of the tape is a problem.

A pure binary tape, a method of punching each byte unaltered directly into a frame, is obviously the most economical format, but complications arise when punching it. Although the bytes are binary data and not characters, the ASR-33 continues to look for and recognize control characters such as form feed, punch-off, etc. By masking these control characters such that they are transparent to the ASR-33, but recognizable by the load program for unmasking, a tape format is devised that loads much faster and is easily duplicated. This format, called Transparent Binary, is in use in my system with a significant reduction in load time. The assembler now loads in 10 minutes.

PUNCH TRANSPARENT BINARY PAPER TAPE

The Punch Transparent Binary (PTB) program formats and punches a Header record (Figure 2) which specifies the program limits and execution address. Control characters are masked by punching a prefixing ESC byte and altering the bit pattern of the control character prior to punching. The ESC character must be considered a control due to its use in the masking process. A Data record (Figure 2) is terminated after 71 data bytes and a CR, LF, and a Block Check Character (BCC) are punched.

LOAD TRANSPARENT BINARY PAPER TAPE

The Load Transparent Binary (LTB) program obtains the program limits and execution address from the Header record, and loads the remaining Data records. The MIKBUG input routine was not used because it strips the parity bit and discards DELETEs. The ESC control characters are noted and discarded. The bit pattern of the byte following the ESC is restored prior to loading. Data integrity is insured by validating the BCC following each Data record. Detecting a disparity in the BCC results in turning off the TTY reader, printing an error message, and terminating the load. At the completion of the loading process, the execution address is setup as required for the MIKBUG 'G' command, and control is passed to MIKBUG. The loaded program may be executed using the MIKBUG 'G' command.

OPERATING INSTRUCTIONS

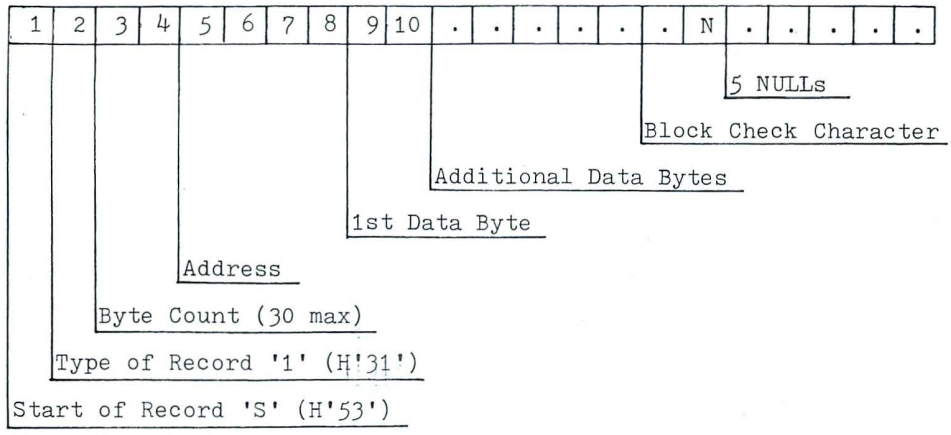
To punch a Transparent Binary tape:

- Load the subject program object tape using the MIKBUG 'L' command.
- Load the PTB program object tape using the MIKBUG 'L' command.
- Store the starting subject program address in hexadecimal address A002-A003 using the MIKBUG 'M' command.
- Store the ending subject program address in hexadecimal address A004-A005 using the MIKBUG 'M' command.
- Store the subject program execution address in hexadecimal address A006-A007 using the MIKBUG 'M' command.
- Execute the PTB program using the MIKBUG 'G' command.

To load a Transparent Binary tape:

- Load the LTB program object tape using the MIKBUG 'L' command.
- Insert the subject program TB tape in the TTY reader.
- Execute the PTB program using the MIKBUG 'G' command.
- Execute the subject program using the MIKBUG 'G' command.

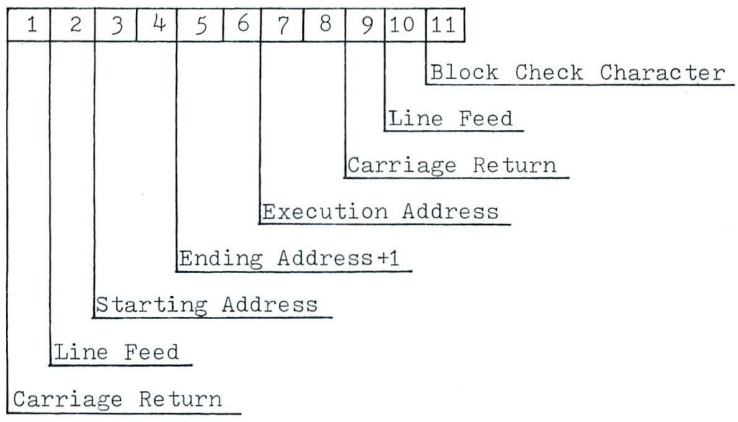
DATA RECORD



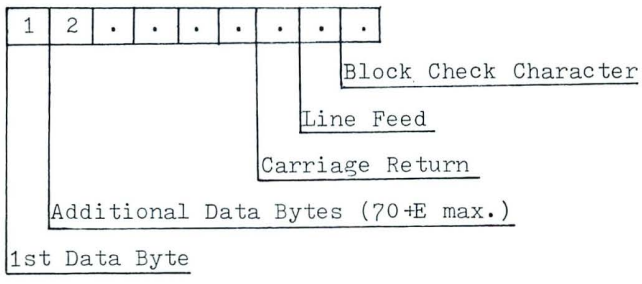
Frames 3-N are hexidecimal digits represented by a 7 bit ASCII character. Two hexidecimal digits are combined to form one 8 bit byte. The checksum is the one's complement of the summation of 8 bit bytes.

FIGURE 1. Paper Tape Format

HEADER RECORD



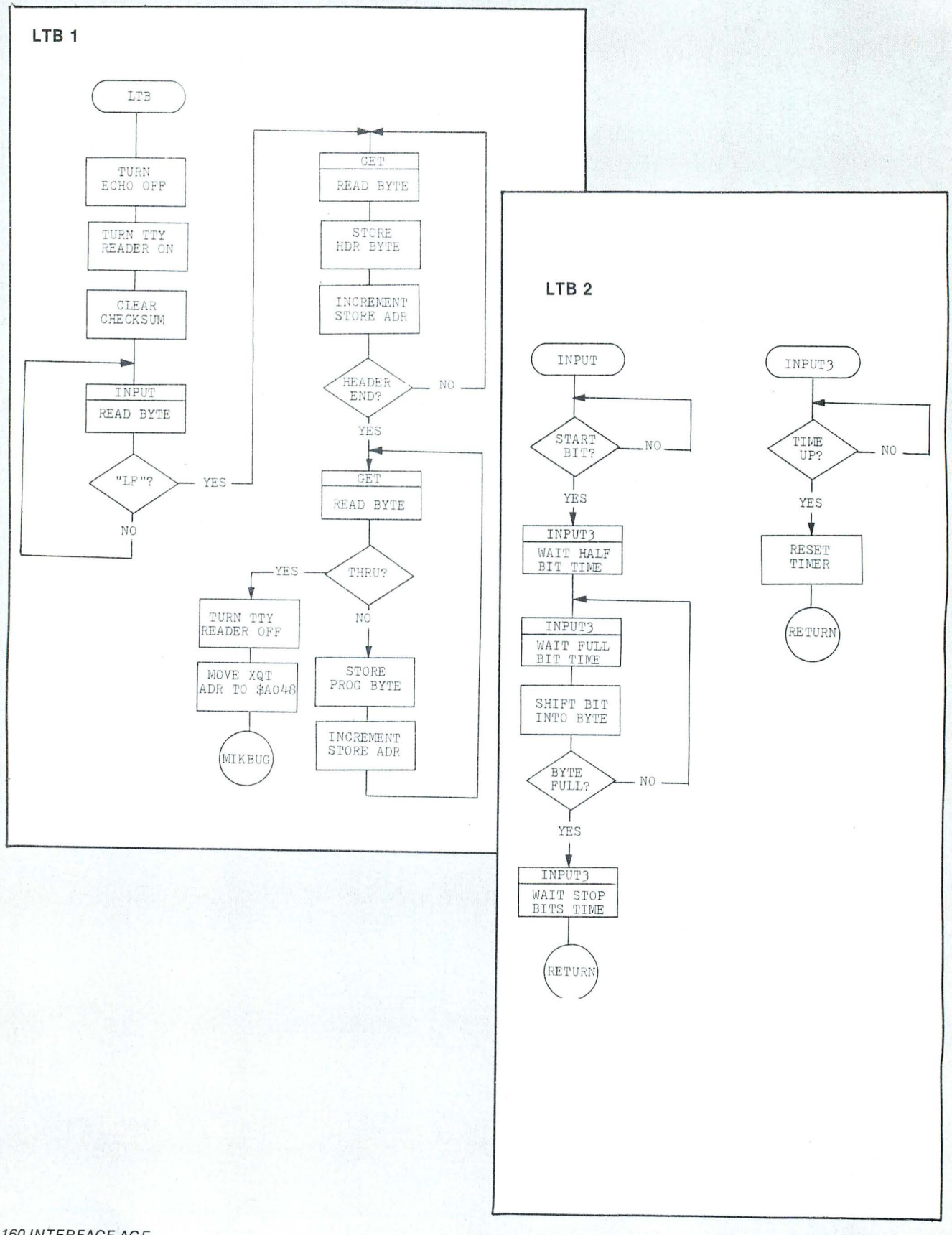
DATA RECORD

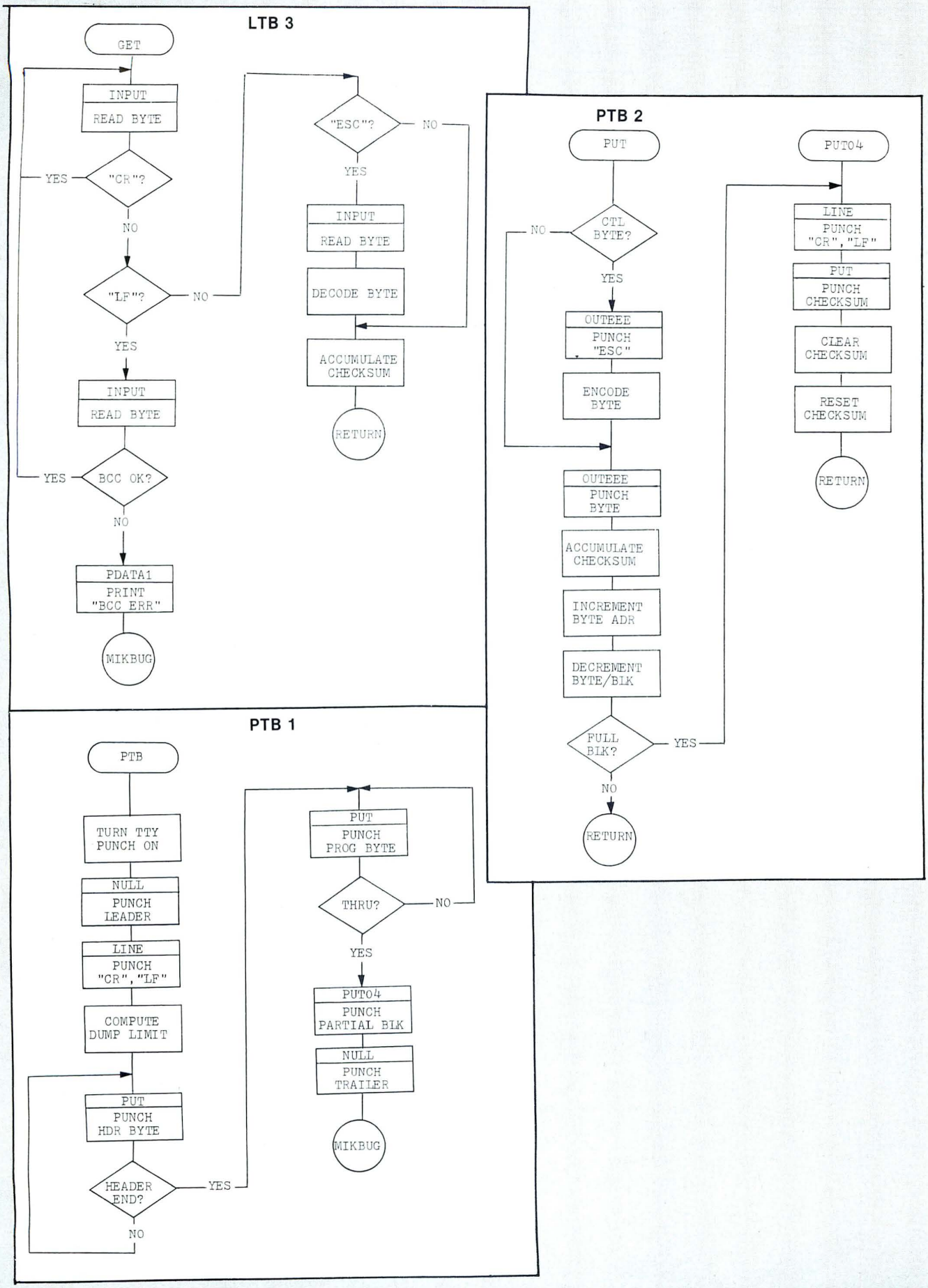


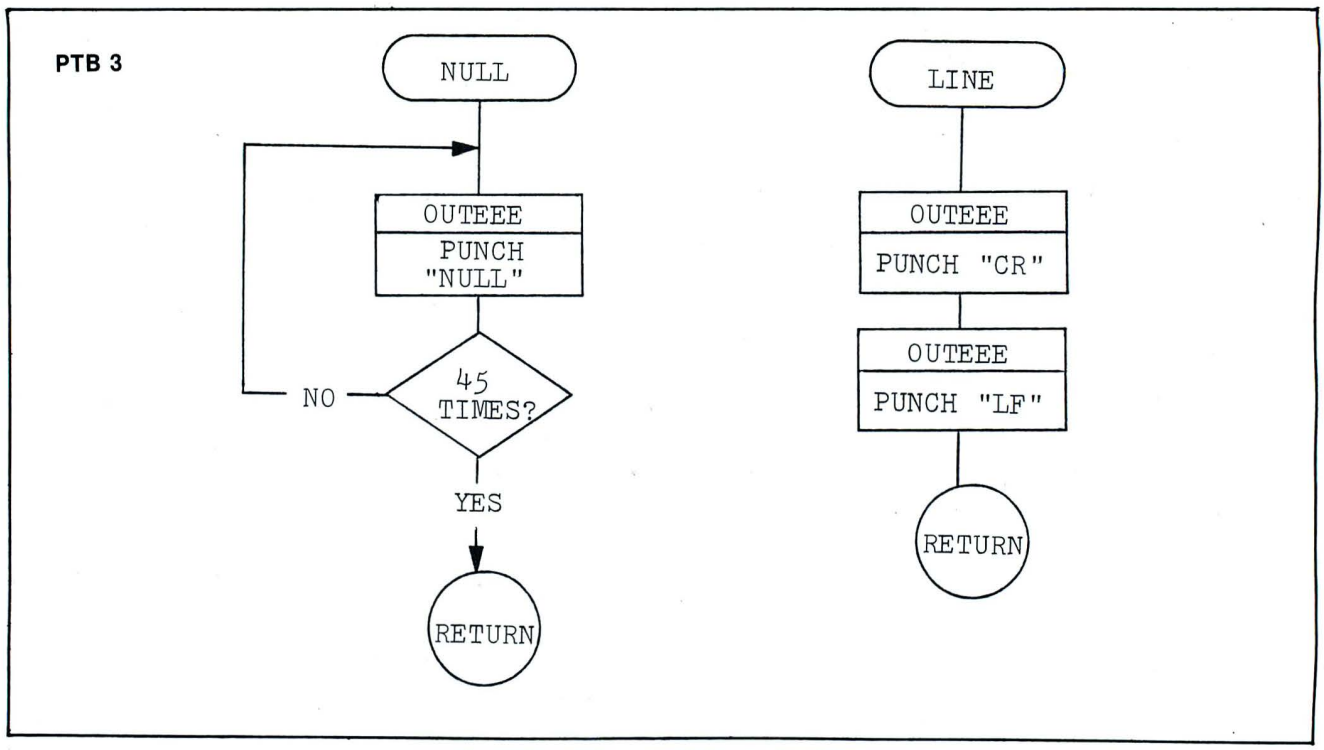
E = Number of ESC frames inserted to mask control characters. The next record always starts immediately after the BCC of previous record.

FIGURE 2. Transparent Binary Paper Tape Format

PROGRAM FLOW DIAGRAMS
LTB First — PTB Second




LTB 3
GET
INPUT
READ BYTE
"CR"?
YES
NO
"LF"?
NO
YES
INPUT
READ BYTE
BCC OK?
YES
NO
PDATA1
PRINT
"BCC ERR"
MIKBUG
"ESC"?
NO
YES
INPUT
READ BYTE
DECODE BYTE
ACCUMULATE
CHECKSUM
RETURN
PTB 2
PUT
CTL
BYTE?
NO
YES
OUTEEE
PUNCH
"ESC"
ENCODE
BYTE
OUTEEE
PUNCH
BYTE
ACCUMULATE
CHECKSUM
INCREMENT
BYTE ADR
DECREMENT
BYTE/BLK
FULL
BLK?
YES
NO
RETURN
PUT04
LINE
PUNCH
"CR","LF"
PUT
PUNCH
CHECKSUM
CLEAR
CHECKSUM
RESET
CHECKSUM
RETURN
PTB 1
PTB
TURN TTY
PUNCH ON
NULL
PUNCH
LEADER
LINE
PUNCH
"CR","LF"
COMPUTE
DUMP LIMIT
PUT
PUNCH
HDR BYTE
HEADER
END?
YES
NO
PUT
PUNCH
PROG BYTE
THRU?
NO
YES
PUT04
PUNCH
PARTIAL BLK
NULL
PUNCH
TRAILER
MIKBUG



LTB PROGRAM ASSEMBLY LISTING

```
00001                          NAM    //LTB/// * LOAD TRANSPARENT BINARY.
00002                          OPT    O       * GENERATE OBJECT TAPE.
00003                  *
00004                  *         FEBRUARY 6, 1977
00005                  *
00006                  *       MIKBUG DEFINITIONS
00007                  *
00008          8004    PIAD   EQU    $8004   * PIA DATA REG A.
00009          8006    PIADB  EQU    $8006   * PIA DATA REG B.
00010          8007    PIASB  EQU    $8007   * PIA CONTROL REG B.
00011          A002    BEGA   EQU    $A002   * STARTING ADDRESS.
00012          A004    ENDA   EQU    $A004   * ENDING ADDRESS +1.
00013          A006    NIO    EQU    $A006   * EXECUTE ADDRESS.
00014          A008    SP     EQU    $A008   * STACK POINTER.
00015          A00A    CKSM   EQU    $A00A   * BCC.
00016          E07E    PDATA1 EQU    $E07E   * PRINT CHARACTER STRING.
00017          E0E3    CONTRL EQU    $E0E3   * LOOK FOR CONTROL.
00018          E1D1    OUTEEE EQU    $E1D1   * OUTPUT 1 CHARACTER.
00019 A048                     ORG    $A048
00020 A048 1F50                FDB    LTB     * DEFINE ENTRY.
00021 1F50                     ORG    $1F50
00022                  *
00023                  *       LOAD TRANSPARENT BINARY
00024                  *
00025 1F50 86 3C       LTB     LDA A  #$3C    * ECHO
00026 1F52 B7 8007             STA A  PIASB   *  OFF.
00027 1F55 CE 1FE9             LDX    #MSG1   * TURN TTY
00028 1F58 BD E07E             JSR    PDATA1  *  READER ON.
00029 1F5B 7F A00A             CLR    CKSM    * PERMIT RE-ENTRY.
00030 1F5E 8D 56       LTB01   BSR    INPUT   * FIRST
00031 1F60 81 0A               CMP A  #$0A    *  LF
00032 1F62 26 FA               BNE    LTB01   *   STARTS.
00033 1F64 CE A002             LDX    #BEGA   * RETRIEVE
00034 1F67 8D 25       LTB02   BSR    GET     *  PROGRAM
00035 1F69 A7 00               STA A  0,X     *   LIMITS
00036 1F6B 08                  INX            *    AND
00037 1F6C 8C A008             CPX    #SP     *     EXECUTE
00038 1F6F 26 F6               BNE    LTB02   *      ADDRESS.
00039 1F71 FE A002             LDX    BEGA    * NEXT
00040 1F74 8D 18       LTB03   BSR    GET     *  BYTE.
00041 1F76 BC A004             CPX    ENDA    *  LOADED?
00042 1F79 26 0E               BNE    LTB04   * NO.
00043 1F7B 86 13               LDA A  #$13    * TURN TTY
00044 1F7D BD E1D1             JSR    OUTEEE  *  READER OFF.
00045 1F80 FE A006             LDX    NIO     * EXECUTE
00046 1F83 FF A048             STX    $A048   *  VIA
00047 1F86 7E E0E3             JMP    CONTRL  *   'G'.
00048 1F89 A7 00       LTB04   STA A  0,X     *  LOAD.
00049 1F8B 08                  INX            *  GET
00050 1F8C 20 E6               BRA    LTB03   *   NEXT.
00051                  *
00052                  *       INPUT BINARY, DECODE TRANSPARENT CHARACTERS
00053                  *
00054 1F8E 8D 26       GET     BSR    INPUT   * DISCARD
00055 1F90 81 0D               CMP A  #$0D    *  CARRIAGE
00056 1F92 27 FA               BEQ    GET     *   RETURNS.
00057 1F94 81 0A               CMP A  #$0A    * LINE FEED?
00058 1F96 26 0E               BNE    GET01   * NO.
00059 1F98 8D F4               BSR    GET     * EXPECTED BCC?
00060 1F9A 27 F2               BEQ    CET     * YES, CONTINUE.
00061 1F9C 31                  INS            * NOTE
00062 1F9D CE 1FED             LDX    #MSG2   *  BCC
00063 1FA0 BD E07E             JSR    PDATA1  *   ERROR!
00064 1FA3 7E E0E3             JMP    CONTRL  * LOOK FOR CONTROL.
00065 1FA6 81 1B       GET01   CMP A  #$1B    * ESCAPE?
00066 1FA8 26 04               BNE    GET02   * NO.
00067 1FAA 8D 0A               BSR    INPUT   * DECODE
00068 1FAC 88 20               EOR A  #$20    *  TRANSPARENCY.
00069 1FAE 16          GET02   TAB            * ACCUMULATE
00070 1FAF F8 A00A             EOR B  CKSM    *  CHECK
00071 1FB2 F7 A00A             STA B  CKSM    *   SUM.
00072 1FB5 39                  RTS            * EXIT.
00073                  *
00074                  *       INPUT ONE CHARACTER
00075                  *
00076 1FB6 B6 8004 INPUT       LDA A  PIAD    * LOOK FOR
00077 1FB9 2B FB               BMI    INPUT   *  START BIT.
00078 1FBB 7F 8006             CLR    PIADB   * DELAY
00079 1FBE 8D 22               BSR    INPUT4  *  HALF
00080 1FC0 8D 1B               BSR    INPUT3  *   BIT.
00081 1FC2 C6 04               LDA B  #4      * SET FULL
00082 1FC4 F7 8006             STA B  PIADB   *  BIT TIME.
00083 1FC7 58                  ASL B          *  8 BITS PER CHAR.
00084 1FC8 8D 13       INPUT1  BSR    INPUT3  * DELAY FULL BIT TIME.
00085 1FCA 0D                  SEC            *  INSERT
00086 1FCB 79 8004             ROL    PIAD    *  CHAR
00087 1FCE 46                  ROR A          *   BIT.
00088 1FCF 5A                  DEC B          *  CHAR COMPLETE?
00089 1FD0 26 F6               BNE    INPUT1  *  NO.
00090 1FD2 F6 8006             LDA B  PIADB   * DELAY
00091 1FD5 58                  ASL B          *  FOR
00092 1FD6 2A 02               BPL    INPUT2  *   APPLICABLE
00093 1FD8 8D 03               BSR    INPUT3  *    STOP
00094 1FDA 8D 01       INPUT2  BSR    INPUT3  *     BITS.
00095 1FDC 39                  RTS            * EXIT.
00096 1FDD 7D 8006 INPUT3      TST    PIADB   * SPECIFIED
00097 1FE0 2A FB               BPL    INPUT3  *  DELAY.
00098 1FE2 7C 8006 INPUT4      INC    PIADB   * RESET
00099 1FE5 7A 8006             DEC    PIADB   *  DELAY.
00100 1FE8 39                  RTS            * EXIT.
00101 1FE9 0D          MSG1    FCB    $0D,$0A,$11,$04
      1FEA 0A
      1FEB 11
      1FEC 04
00102 1FED 13          MSG2    FCB    $13,$0D,$0A,$FF
      1FEE 0D
      1FEF 0A
      1FF0 FF
00103 1FF1 2A                  FCC    /** BCC ERR **/
      1FF2 2A
      1FF3 20
      1FF4 42
      1FF5 43
      1FF6 43
      1FF7 20
      1FF8 45
      1FF9 52
      1FFA 52
      1FFB 20
      1FFC 2A
      1FFD 2A
00104 1FFE 04                  FCB    $04
00105                          END

TOTAL ERRORS 00000


M6800 RESIDENT ASSEMBLER
ENTER PASS : 1P,1S,2P,2L,2T

2TS00B00002F2F4C54422F2F2F27
S105A0481F50A3
S11E1F50863CB78007CE1FE9BDE07E7FA00A8D56810A26FACEA0028D25A70001
S11E1F6B088CA00826F6FEA0028D18BCA004260E8613BDE1D1FEA006FFA04893
S11E1F867EE0E3A7000820E68D26810D27FA810A260E8DF427F231CE1FEDBDC3
S11E1FA1E07E7EE0E3811B26048D0A882016F8A00AF7A00A39B6800423FB7F0C
S11E1FBC80068D228D1BC604F7006588D130D798004465A26F6F6B006582A26
S11E1FD7028D038D01397D80062AFB7C80067A8006390D0A1104130D0AFF2AB0
```

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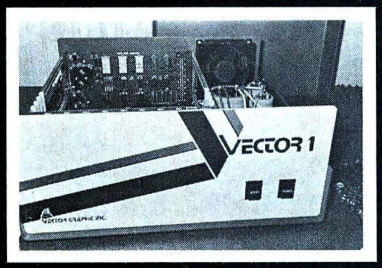

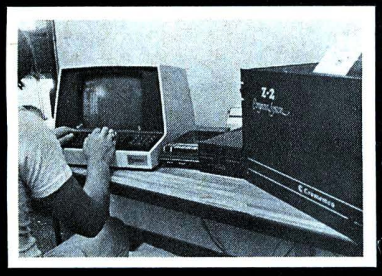

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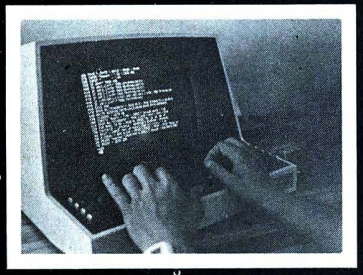

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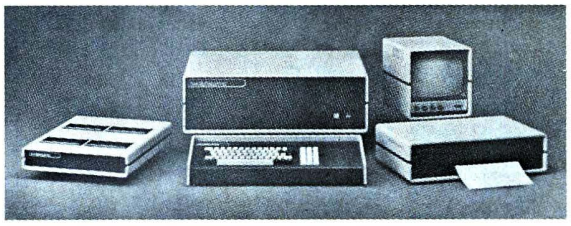

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```
S1101FF22A2042434320455252202A2A044B
S9030000FC

TOTAL ERRORS 00000

M6800 RESIDENT ASSEMBLER
ENTER PASS : 1P,1S,2P,2L,2T
```

PTB PROGRAM ASSEMBLY LISTING

```
00001                          JAM    //PTB/// * PUNCH TRANSPARENT BINARY.
00002                          OPT    O       * GENERATE OBJECT TAPE.
00003                  *
00004                  *         FEBRUARY 5, 1977
00005                  *
00006                  *       MIKBUG DEFINITIONS
00007                  *
00008        A002      BEGA    EQU    $A002    * STARTING ADDRESS.
00009        A004      ENDA    EQU    $A004    * ENDING ADDRESS.
00010        A00A      CKSM    EQU    $A00A    * BCC.
00011        E0E3      CONTRL  EQU    $E0E3    * LOOK FOR CONTROL.
00012        E1D1      OUTEEE  EQU    $E1D1    * OUTPUT 1 CHARACTER.
00013 A048                     ORG    $A048
00014 A048 1F6F                FDB    PTB      * DEFINE ENTRY.
00015 1F6F                     ORG    $1F6F
00016                  *
00017                  *         PUNCH TRANSPARENT BINARY
00018                  *
00019 1F6F 86 12   PTB    LDA A  #$12     * TURN ON
00020 1F71 8D 75          BSR    PUTOUT   *  TTY PUNCH.
00021 1F73 8D 76          BSR    NULL     * PUNCH LEADER.
00022 1F75 8D 7E          BSR    LINE     * NEW LINE.
00023 1F77 7F A00A        CLR    CKSM     * PERMIT RE-ENTRY.
00024 1F7A FE A004        LDX    ENDA     * SET
00025 1F7D 08             INX             *  DUMP
00026 1F7E FF A004        STX    ENDA     *   LIMIT.
00027 1F81 C6 06          LDA B  #6       * PUNCH
00028 1F83 CE A002        LDX    #BEGA    *  LIMITS
00029 1F86 8D 15   PTB01  BSR    PUT      *   AND
00030 1F88 C1 06          CMP B  #6       *     EXECUTE
00031 1F8A 23 FA          BLS    PTB01    *       ADDRESS.
00032 1F8C FE A002        LDX    BEGA     * PUNCH
00033 1F8F 8D 0C   PTB02  BSR    PUT      *  BYTE.
00034 1F91 BC A004        CPX    ENDA     * THRU?
00035 1F94 26 F9          BNE    PTB02    * NO.
00036 1F96 8D 40          BSR    PUT04    * PUNCH PARTIAL BLK.
00037 1F98 8D 51          BSR    NULL     * PUNCH TRAILER.
00038 1F9A 7E E0E3        JMP    CONTRL   * BACK TO MIKBUG!
00039                  *
00040                  *       PUNCH BINARY, ENCODING CONTROL CHARACTERS
00041                  *
00042 1F9D A6 00   PUT    LDA A  0,X      * IGNORE
00043 1F9F 84 7F          AND A  #$7F     *  PARITY.
00044 1FA1 81 1B          CMP A  #$1B     * ESCAPE?
00045 1FA3 27 18          BEQ    PUT01    * YES.
00046 1FA5 81 0A          CMP A  #$0A     * LINE FEED?
00047 1FA7 27 14          BEQ    PUT01    * YES.
00048 1FA9 81 0C          CMP A  #$0C     * FORM FEED?
00049 1FAB 27 10          BEQ    PUT01    * YES.
00050 1FAD 81 0D          CMP A  #$0D     * CARRIAGE RETURN?
00051 1FAF 27 0C          BEQ    PUT01    * YES.
00052 1FB1 81 05          CMP A  #$05     * ENQ?
00053 1FB3 27 08          BEQ    PUT01    * YES.
00054 1FB5 81 10          CMP A  #$10     * DCI
00055 1FB7 23 0E          BLS    PUT02    *  THRU
00056 1FB9 81 14          CMP A  #$14     *   DC4?
00057 1FBB 22 0A          BHI    PUT02    * NO.
00058 1FBD 86 1B   PUT01  LDA A  #$1B     * PUNCH
00059 1FBF 8D 27          BSR    PUTOUT   *  ESCAPE.
00060 1FC1 A6 00          LDA A  0,X      * ENCODE
00061 1FC3 88 20          EOR A  #$20     *  CONTROL
00062 1FC5 20 02          BRA    PUT03    *   CHARACTER.
00063 1FC7 A6 00   PUT02  LDA A  0,X      * PUNCH
00064 1FC9 8D 1D   PUT03  BSR    PUTOUT   *  BINARY.
00065 1FCB A6 00          LDA A  0,X      * ACCUMULATE
00066 1FCD B8 A00A        EOR A  CKSM     *  CHECK
00067 1FD0 B7 A00A        STA A  CKSM     *   SUM.
00068 1FD3 08             INX             * STEP TO NEXT.
00069 1FD4 5A             DEC B           * END OF BLOCK?
00070 1FD5 27 01          BEQ    PUT04    * YES.
00071 1FD7 39             RTS             * EXIT.
00072 1FD8 8D 1B   PUT04  BSR    LINE     * NEW LINE.
00073 1FDA FF 1FFE        STX    INDEX    * PUNCH
00074 1FDD CE A00A        LDX    #CKSM    *  BLOCK
00075 1FE0 8D BB          BSR    PUT      *   CHECK
00076 1FE2 FE 1FFE        LDX    INDEX    *    CHARACTER.
00077 1FE5 C6 47          LDA B  #71      * CHAR PER BLK.
00078 1FE7 39             RTS             * EXIT.
00079 1FE8 7E E1D1 PUTOUT JMP    OUTEEE   * OUTPUT 1 CHARACTER.
00080                  *
00081                  *       PUNCH STREAM OF NULLS
00082                  *
00083 1FEB C6 2D   NULL   LDA B  #45      * PUNCH
00084 1FED 86 00   NULL1  LDA A  #$00     *  45
00085 1FEF 8D F7          BSR    PUTOUT   *   CONTIGUOUS
00086 1FF1 5A             DEC B           *    NULL
00087 1FF2 26 F9          BNE    NULL1    *     CHARACTERS.
00088 1FF4 39             RTS             * EXIT.
00089                  *
00090                  *       PUNCH CARRIAGE RETURN AND LINE FEED
00091                  *
00092 1FF5 86 0D   LINE   LDA A  #$0D     * CARRIAGE
00093 1FF7 8D EF          BSR    PUTOUT   *  RETURN.
00094 1FF9 86 0A          LDA A  #$0A     * LINE
00095 1FFB 8D EB          BSR    PUTOUT   *  FEED.
00096 1FFD 39             RTS             * EXIT.
00097 1FFE 0002   INDEX   RMB    2        * INDEX REGISTER.
00098                     END

TOTAL ERRORS 00000


M6800 RESIDENT ASSEMBLER
ENTER PASS : 1P,1S,2P,2L,2T

2TS00B00002F2F5054422F2F2F23
S105A0481F6F84
S11E1F6F86128D758D768D7E7FA00AFEA00408FFA004C606CEA0028D15C10690
S11E1F8A23FAFEA0028D0CBCA00426F98D408D517EE0E3A600847F811B2718F3
S11E1FA5810A2714810C2710810D270C81052708811023 0E8114220A861B8D6C
S11E1FC027A6008820200 2A6008D1DA600B8A00AB7A00A0855A2701398D1BFF48
S11E1FDB1FFECEA00A8DBBFE1FFEC647397EE1D1C62D86008DF75A26F9398644
S10B1FF60D8DEF860A8DEB3915
S9030000FC

TOTAL ERRORS 00000

M6800 RESIDENT ASSEMBLER
ENTER PASS : 1P,1S,2P,2L,2T
```

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9626K 8K Static RAM Kit	275.00
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9551	14.95
9555	14.95
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6810-1	4.95
6810	6.25
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6834	21.95
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Hard Man	15.00
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2905	9.95
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2911	3.95
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29721	7.95
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Z80CTC	14.95
6502	24.95
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21L02(250ns)	2.25
2102(450ns)	1.69
2102(650ns)	1.59
2102(1 sec)	1.40
2111	3.95
21L11	4.25
2112	2.95
2101	2.95
21L01	3.95
74C89	4.95
74S189	2.95
7489	1.88
4116 16K	44.95
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4096 16 pin	4.95
2107B-4	4.25
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MM5262	1.95
MM5280	4.95
8599	1.88
P3101	2.95
5101C E	9.95
3107	3.95
1101	1.95
1103	1.95
4008 L	2.95

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6306-1	9.95
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6353	18.95
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5204	16.95
6834	21.95
6834-1	16.95
82 & 16	4.50
8223	2.95
5203	6.95

7400TTL

7400N	.15
7401N	.19
7402N	.18
7403N	.19
7404N	.19
7405N	.22
7406N	.29
7407N	.29
7408N	.25
7409N	.25
7410N	.18
7411N	.28
7412N	.39
7413N	.45
7414N	.69
7416N	.35
7417N	.35
7420N	.20
7421N	.33
7422N	.47
7423N	.37
7425N	.39
7426N	.35
7427N	.35
7428N	.49
7430N	.22
7432N	.31
7437N	.27
7438N	.27
7440N	.22
7441N	.85
7442N	.59
7443N	.75
7444N	.75
7445N	.75
7446N	.79
7447N	.65
7448N	.75
7450N	.22
7451N	.26
7453N	.26
7454N	.22
7459N	.29
7460N	.29
7470N	.44
7472N	.36
7473N	.36
7474N	.31
7475N	.48
7476N	.36
7479N	4.70
7480N	.59
7482N	.99
7483N	.70
7485N	.97
7486N	.39
7488N	3.95
7489N	2.25
7490N	.45
7491N	.65
7492N	.45
7493N	.45
7494N	.75
7495N	.79
7496N	.99
7497N	4.25
74100	.99
74104	.69
74105	.69
74107	.39
74109	.49
74121	.35
74122	.49
74123	.65
74125	.58
74126	.58
74132	1.05
74136	1.10
74141	1.10
74142	3.75
74143	3.95
74144	4.95
74145	1.05
74147	2.25
74148	1.79
74150	.95
74151	.75
74153	.90
74154	1.29
74155	.99
74156	.95
74157	.95
74158	1.79
74160	1.20
74161	.95
74162	.95
74163	.95
74164	1.05
74165	1.05
74166	1.00
74170	2.49
74172	8.49
74173	1.49
74174	1.25
74175	.90
74176	.90
74177	.90
74180	.89
74181	2.39
74182	.95
74184	2.10
74185	2.25
74186	14.50
74190	1.15
74191	1.15
74192	.99
74193	.99
74194	1.39
74195	.75
74196	1.19
74197	1.19
74198	1.69
74199	1.69

74LS00 TTL

74 LS00	.22
LS02	.24
LS04	.24
LS05	.28
LS08	.28
LS10	.28
LS13	.79
LS14	1.69
LS20	.26
LS27	.38
LS30	.26
LS32	.34
LS40	.26
LS42	1.10
LS51	.26
LS73	.56
LS74	.56
LS75	.79
LS76	.59
LS83	1.69
LS85	1.99
LS86	.55
LS90	1.10
LS92	1.10
LS93	1.10
LS95	1.69
LS107	.56
LS109	.56
LS112	.56
LS113	.56
LS123	.99
LS132	1.10
LS136	.99
LS138	1.39
LS139	1.49
LS151	1.49
LS153	1.29
LS155	1.49
LS157	1.29
LS158	1.29
LS161	1.39
LS162	1.39
LS163	1.39
LS164	1.39
LS174	1.39
LS175	1.39
LS190	2.49
LS191	2.49
LS192	2.49
LS193	2.49
LS194	2.49
LS195	.52
LS251	1.39
LS253	1.49
LS257	1.29
LS258	1.29
LS279	1.10
LS283	1.10
LS367	.99
LS368	.99
LS377	1.29

74S & 74L

LS378	1.29
81LS95	1.10
81LS96	1.10
81LS97	1.10
81LS98	1.10
74S00	.40
74S04	.42
74S08	.49
74S10	.40
74S11	.40
74S20	.40
74S30	.40
74S32	.78
74S37	.85
74S38	.95
74S40	.40
74S74	.79
74S138	1.69
74S139	1.69
74S151	1.49
74S158	1.49
74S174	1.59
74S175	1.59
74S189	2.95
74S201	3.95
74S251	1.69
74S257	1.69
74L00	.39
74L04	.39
74L10	.39
74L20	.39
74L30	.39
74L42	1.29
74L73	.89
74L74	.89
74L85	1.49
74L86	1.49
74L90	1.29
74L95	1.29
74L154	1.59
74L164	1.69
74L165	1.89
74L192	1.99
74L193	1.99

4000 CMOS

CD4000	.25
CD4001	.25
CD4002	.25
CD4006	1.69
CD4007	.25
CD4008	1.69
CD4009	.55
CD4010	.55
CD4011	.25
CD4012	.25
CD4013	.55
CD4014	1.95
CD4015	1.95
CD4016	.55
CD4017	.99
CD4018	2.39
CD4019	.55
CD4020	1.39
CD4021	1.85
CD4022	1.20
CD4023	.29
CD4024	1.25
CD4025	.29
CD4026	1.95
CD4027	.59
CD4028	1.50
CD4029	1.70
CD4030	.42
CD4033	2.49
CD4034	4.95
CD4035	1.79
CD4040	1.05
CD4041	1.95
CD4042	1.45
CD4043	1.45
CD4044	1.45
CD4047	1.95
CD4049	.61
CD4050	.61
CD4051	1.25
CD4052	1.25
CD4059	1.95
CD4063	2.49
CD4068	.35
CD4069	.35
CD4070	.35
CD4071	.35
CD4072	.35
CD4073	.35
CD4075	.35
CD4078	.35
CD4081	.40
CD4082	.40
CD4094	2.49
40160	2.10
40161	2.10
40174	2.10
4508	3.95
4510	1.99
4511	1.99
4515	3.95
4516	1.99
4518	1.99
4520	2.49
4522	2.56
4526	2.56
4527	2.69
4528	1.50
4531	1.99
4532	2.69
4543	2.25
4555	1.79
4556	1.79
4581	4.90
4582	1.99
4585	2.49
4901	.49
4911	.49
74C00	.35
74C04	.35
74C10	.35
74C20	.35
74C30	.35
74C42	1.95
74C48	2.90
74C73	.85
74C74	.85
74C76	1.39
74C85	1.25
74C86	1.79
74C89	4.95
74C90	1.25
74C93	1.35
74C95	1.49
74C106	1.49
74C107	1.10
74C151	1.70
74C154	2.75
74C160	1.40
74C161	2.10
74C174	2.10
74C192	2.39
74C193	2.39
74C221	2.65

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LM300H	.80
LM301H	.45
LM301CN	.45
LM302H	1.25
LM304H	1.20
LM305H	.85
LM306H	.95
LM307CN	.45
LM307H	.45
LM308H	1.00
LM308CN	1.00
LM309H	1.10
LM309K	1.25
LM310H	1.15
LM311H	.90
LM311CN	.59
LM312H	1.95
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LM318N	1.50
LM320K/ 340K-5, 8, 12, 15, 24	1.95
LM320T/ 340T-5, 8, 12, 15, 24	1.45
LM324N	1.65
LM339N	1.55
LM370H	1.65
LM373N	3.95
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LM380N	1.00
LM381N	1.90
LM384N	2.49
LM555CN	.59
LM556CN	1.69
LM566CN	2.00
LM567CN	1.95
LM565CN	1.95
LM565H	1.95
LM703CH	1.49
LM709N	.49
LM709CH	.49
LM710N	.70
LM711N	.49
LM711CH	.49
LM723N	.55
LM723CH	.55
LM725CH	3.25
LM733N	1.00
LM733H	1.29
LM739N	1.29
LM741CH	.35
LM741CN	.39
LM747N	.75
LM747H	.75
LM748H	.39
LM748N	.39
LM1414N	1.75
LM1458CN	.65
LM1496N	.95
LM2111N	1.95
LM2901N	1.95
LM3065N	.69
LM3900N	.55
LM3909	1.10
LM7520	2.25
LM7524N	1.75
LM7525N	1.90
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2N5134	5/$1.00
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SP8794	16.95
SP8685	

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13.0MH$_3$	4.95
14.31818	4.95
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XR1800CP	3.00
XR2206CP	5.25
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$100 BUS S/T IMSAI	5.00
$100 BUS W/W ALTAIR	5.50
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CTS206-6	$1.75
CTS207-7	$1.75
CTS208-8	$1.95
CTS209-9	$1.95
CTS209-10	$1.95

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EVK 99 Kit	$133.00
EVK 99 EX expanded	449.95
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6 Slot Motherboard	35.00
Extender Board	45.00
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Assembled & Tested $199.95
Kit Price Only $179.95

Features:

Lowpower 21L02, 450ns, Dip Switch Selectable addressing down to 256 Byte blocks, No wait states, fully buffered, battery back-up.

Plus the first 32K Static Memory Board Uses 2114 4K RAMS

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24K	859.98
32K	999.99

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2716 EPROM	$59.95
Z-80A 4MH$_3$	$49.95
Z-80 2.5MH$_3$	$29.95
INTEL 3404 6 bit latch	$2.95
INTEL 3205 driver	$1.95
MK4116 16K RAM	$44.95
2114 4K RAM	$12.95
4200A 4K RAM	$12.95

SPECIALS

2708 price war $21.95

8K Ram Kit $179.95

8T97	$1.49
8T26	2 for $4.95
8097/74367	6 for $5.00
1488	$1.25
1489	$1.25
DM8130	2 for $4.95
DM8131	2 for $4.95
MH0026	$2.95
75452	10/2.50
74LS138	$1.39
74166	$ .69
741HC	10/2.50
93L00	10/3.50
LM301AH	10/2.50
LM308H	10/4.95
MC1733CL	10/4.95
7438	10/2.50
4558	10/4.95
8T22A	10/2.95
8835	$1.95
8836	$1.95
8837	$1.95
8098/74368	6/5.00
1702A 6	10/39.95
2708	$21.95
21L02-1	8/12.95
P2102	16/17.95
74125	10/3.75
LM323K	2/12.95
MCT2	.99
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Plus huge backup inventory with special pricing for VOLUME requirements. Call for a quotation

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MOT MEK6800 D2	235.00
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74LS03	.28	74LS38	.33	74LS107	.39	74LS161	1.02	74LS257	.75
74LS04	.29	74LS40	.28	74LS109	.39	74LS162	1.02	74LS258	.75
74LS05	.29	74LS42	.67	74LS112	.39	74LS163	1.02	74LS266	.39
74LS08	.29	74LS47	.79	74LS113	.39	74LS164	1.02	74LS283	.79
74LS09	.29	74LS48	.77	74LS114	.39	74LS168	1.14	74LS290	.65
74LS10	.28	74LS51	.28	74LS125	.49	74LS169	1.14	74LS293	.65
74LS11	.28	74LS54	.28	74LS126	.49	74LS170	1.73	74LS365	.67
74LS12	.28	74LS55	.28	74LS132	.81	74LS173	1.34	74LS366	.67
74LS13	.47	74LS73	.39	74LS136	.39	74LS174	1.06	74LS367	.67
74LS14	1.02	74LS74	.39	74LS138	.73	74LS175	.84	74LS368	.67
74LS15	.28	74LS75	.53	74LS139	.73	74LS190	1.18	74LS386	.39
74LS20	.28	74LS76	.39	74LS151	.75	74LS191	1.18	74LS670	2.34
74LS21	.28	74LS78	.39	74LS153	.75	74LS196	.86	81LS95	.77
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74LS26	.33	74LS86	.39	74LS155	.75	74LS247	.79	81LS97	.77
74LS27	.33			74LS156	.75			81LS98	.77

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7400	.21	7476	.32	74181	2.15	4012	.23	4520	1.14
7401	.21	7480	.70	74182	.79	4013	.40	4527	1.68
7402	.21	7482	.70	74184	2.19	4014	.96	4528	.88
7403	.21	7483	.70	74185	2.19	4015	.96	4585	1.23
7404	.21	7485	.89	74188	3.50	4016	.40	2102-1	1.79
7405	.21	7486	.28	74189	3.50	4017	1.05	8080A	12.95
7406	.25	7489	2.19	74190	1.23	4018	1.05	CA3046	.75
7407	.25	7490	.44	74191	1.23	4019	.23	LM2111N	1.25
7408	.21	7491	.70	74192	.88	4020	1.14	LM309K	1.80
7409	.21	7492	.44	74193	.88	4021	1.14	LM324A	1.28
7410	.21	7493	.44	74194	.88	4022	.96	LM340T-5	1.25
7411	.27	7494	.70	74195	.88	4023	.23	LM340T-6	1.25
7412	.21	7495	.70	74196	.88	4024	.84	LM340T-8	1.25
7413	.25	7496	.70	74197	.88	4025	.23	LM340T-12	1.25
7414	.89	74100	1.28	74198	1.49	4026	1.68	LM340T-15	1.25
7416	.25	74107	.30	74199	1.49	4027	.40	LM340T-18	1.25
7417	.25	74109	.33	74251	1.09	4028	.89	LM340T-24	1.25
7420	.21	74121	.35	74279	.55	4029	1.14	LM3900N	.88
7421	.25	74122	.44	74365	.67	4030	.23	LM3909N	.69
7423	.35	74123	.61	74366	.67	4033	1.51	MC1456V	1.00
7425	.35	74125	.40	74367	.67	4034	3.50	MC1458V	.53
7426	.25	74126	.40	74368	.67	4035	1.14	MC3302P	1.15
7427	.33	74132	.70	8093	.40	4040	1.14	NE536T	3.24
7428	.28	74141	.88	8094	.40	4041	.79	NE540L	2.04
7430	.21	74145	.70	9095	.67	4042	.79	NE555V	.48
7432	.25	74147	1.63	8096	.67	4043	.70	NE556A	.88
7433	.30	74148	1.30	8097	.67	4044	.70	NE560B	3.83
7437	.25	74150	1.16	8098	.67	4046	1.86	NE561B	3.83
7438	.25	74151	.70	75150	1.16	4049	.40	NE562B	3.83
7440	.21	74153	.65	75450	.88	4050	.40	NE565A	1.25
7442	.53	74154	1.03	75451	.61	4051	1.26	NE566V	1.28
7443	.63	74155	.70	75452	.61	4052	1.26	NE567V	1.36
7445	.70	74156	.70	75453	.61	4053	1.26	uA709CV	.44
7446	.70	74157	.70	75454	.61	4060	1.58	uA710CA	.44
7447	.70	74160	.88	75491	.81	4066	.79	uA711CA	.53
7448	.70	74161	.88	75492	.84	4071	.23	uA723CA	.60
7450	.21	74162	.88	75493	1.09	4072	.23	uA733CA	.75
7451	.21	74163	.88	75494	1.19	4073	.23	uA741CV	.44
7453	.21	74164	.96	82525	2.19	4075	.23	uA747CA	.70
7454	.21	74165	1.15	4000	.23	4081	.23	uA748CV	.49
7459	.21	74166	1.26	4001	.23	4082	.23	uA7805CU	1.25
7460	.21	74170	2.64	4002	.23	4502	.79	uA7806CU	1.25
7470	.30	74173	1.42	4006	1.23	4510	1.14	uA7808CU	1.25
7472	.30	74174	.98	4007	.23	4511	1.05	uA7812CU	1.25
7473	.30	74175	.93	4008	.79	4514	2.80	uA7815CU	1.25
7474	.30	74176	.79	4009	.44	4515	2.80	uA7818CU	1.25
7475	.49	74177	.79	4010	.44	4516	1.23	uA7824CU	1.25
		74180	.70	4011	.23	4518	1.14		

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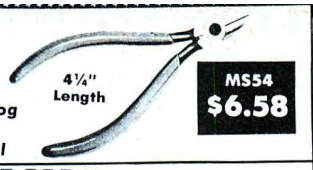

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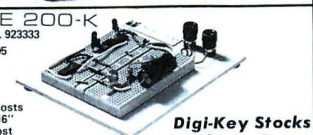

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MPS2222A	.16	1.55/10	MPS3643	.16	1.55/10	PN5137	.16	1.55/10
MPS2369A	.16	1.55/10	MPS3646	.16	1.55/10	PN5138	.16	1.55/10
MPS2712	.16	1.55/10	2N3904	.16	1.55/10	PN5139	.16	1.55/10
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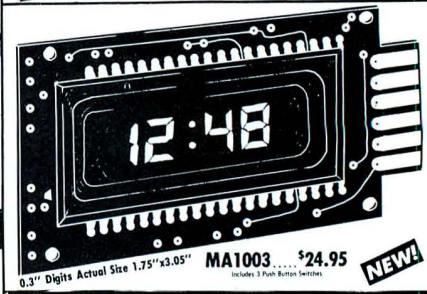

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10/25V	.08	.65/10	.12 1.00/10	330/6V	.14	1.12/10	.19 1.48/10
10/35V	.09	.70/10	.13 1.10/10	330/10V	.15	1.16/10	.21 1.64/10
10/50V	.10	.75/10	.14 1.15/10	330/16V	.21	1.66/10	.31 2.45/10
22/16V	.08	.67/10	.12 1.00/10	330/25V	.23	1.86/10	.38 3.07/10
22/25V	.09	.70/10	.13 1.05/10	330/35V	.33	2.66/10	.43 3.43/10
22/35V	.11	.85/10	.15 1.19/10	330/50V	.54	4.30/10	.60 4.81/10
22/50V	.12	1.00/10	.17 1.32/10	470/6V	.15	1.21/10	.20 1.61/10
33/16V	.09	.75/10	.12 1.00/10	470/10V	.21	1.71/10	.31 2.45/10
33/25V	.10	.81/10	.14 1.15/10	470/16V	.23	1.81/10	.33 2.66/10
33/35V	.13	1.05/10	.17 1.34/10	470/25V	.29	2.35/10	.43 3.43/10
33/50V	.14	1.13/10	.19 1.52/10	470/35V	.41	3.27/10	.47 3.78/10
47/10V	.09	.71/10	.13 1.04/10	470/50V	.54	4.30/10	.75 6.03/10
47/16V	.10	.81/10	.14 1.15/10	1000/6V	.22	1.90/10	.35 2.76/10
47/25V	.13	1.05/10	.17 1.30/10	1000/10V	.24	1.96/10	.38 3.07/10
47/35V	.15	1.13/10	.19 1.51/10	1000/16V	.29	2.35/10	.43 3.43/10
45/50V	.15	1.21/10	.21 1.71/10	1000/25V	.42	3.33/10	.68 5.42/10
100/10V	.10	.77/10	.14 1.13/10	1000/35V	.60	4.81/10	.75 6.03/10
100/16V	.11	.85/10	.17 1.30/10	2200/6V	.36	2.86/10	.43 3.43/10
100/25V	.13	1.10/10	.20 1.55/10	2200/10V	.42	3.33/10	.60 4.81/10
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.0047 uf	.40/10	3.50/C
.01 uf	.45/10	3.65/C
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Z-80 DEVELOPMENT SYSTEM DISC I/O KEYBOARD HANDLER

by Richard E. Maly
Quay Corporation

The DISC I/O (DISCIO) routine is designed to run on the Zilog Z-80 Development System and allows the user to manipulate files using the console keyboard in ways that he cannot do it under file maintenance.

DISC I/O is a Monitor Mode routine which permits keyboard operation of disc I/O. The routine has an ORG = 1C80, and must be moved and saved as described in QDOS. Once the routine is saved, it may be loaded using DEBUG.

> GET DISCIO U (START)

These are two restart addresses from DEBUG Mode, 1C80 and 1C91.

> J 1C80

This restart address will reload ZDOS and initialize the discs. The alternate restart is:

> J 1C91

This restart address will print the message at the beginning of the keyboard handler, and should be used to restart once ZDOS is loaded, and files are open.

DISCIO will print a message on entry and after that will only print a prompt character ">", unless the command "S" is entered or an invalid command is entered, when the START message is printed. The DISC I/O commands are:

D	Returns to DEBUG Mode, Address 0132H.
O	Returns to OS, Address 0FEH.
N	Enter a new File Name (See Below).
C	Enter a Disc Command (See Below).
S	Print the starting message.
L	Reload and initialize ZDOS.

The first command to DISC I/O should be a file definition:

N NAME EXT UNIT ADDRESS

NAME = Users File Name.
EXT = File Type ; A-E are 8 sector records.
; (1K bytes), F-T are 1 sector print records.
U-Z are 1 sector records.
ADDRESS = Start of User Buffer in HEX where data is to be read or written.

Once a file is defined, commands may be used.

C CMD #RECORDS

Valid Z-80 development system disc commands are:

CREATE	Creates a new file.
CLOSE	Closes an open file.
ERASE	Erases a file.
DELETE*	Deletes records within a file.
RDN*	Reads next N records.
RCR*	Reads current record.
RPR	Reads previous record.
REW	Rewinds to beginning of file.
SF*	Skips forward N records.
SB*	Skips back N records.
OPEN	Open a file.
WN*	Write N records (insert).
WR*	Replace current record.

Files marked * must have a number of records specified in the command.

ASSEMBLY PROGRAM LISTING

```
                                DISCIO LISTING    4/27/77       PAGE  0001
LOC   OBJ CODE    STMT SOURCE STATEMENT

                  0001 ; QUAY CORPORATION
                  0002 ; P.O. BOX 386
                  0003 ; FREEHOLD, N.J. 07728
                  0004 ;
                  0005 ; WRITTEN BY R.E.MALY
                  0006 ;
                  0007 ; THIS ROUTINE RUNS IN Z80 DEVELOPMENT SYSTEM MON
                  0008 ; MODE AND MUST BE MOVED TO 0C80
                  0009 ; THEN SAVED BEFOR IT WILL RUN
                  0010 ; USE GET DISCIO U (START) TO GO
                  0011 ; THIS IS A KEYBOARD COMMAND HANDLER
                  0012 ; TO USE ZDOS IN MONITOR MODE.
1C80              0013   ORG 1C80H
1C80  CDF30A      0014 BEGIN CALL LOAD
1C83  3F08        0015    LD A 08H
1C85  325C1F      0016    LD (CMND) A
1C88  215C1F      0017    LD HL CMND
1C8B  CDF71D      0018    CALL MDOS
1C8E  C3911C      0019     JP START
1C91  218B1E      0020 START LD HL MSG0
1C94  013900      0021       LD BC END0
1C97  CD3006      0022       CALL PUTMSG
1C9A  FF          0023 INPUT     RST GET     ; GET A COMMAND
1C9B  FE4F        0024       CP 'N'      ; NEW FILE?
1C9D  CAF21C      0025       JP Z FILE0  ; YES
1CA0  FE4F        0026       CP 'O'
1CA2  CAFE00      0027       JP Z OS       ; GOTO OS
1CA5  FE44        0028       CP 'D'
1CA7  CAE61C      0029       JP Z DEBUG    ; GOTO DEBUG
1CAA  FE48        0030      CP 'H'
1CAC  CACD1E      0031      JP Z HELP
1CAF  FE53        0032     CP 'S'
1CB1  CA911C      0033     JP Z START
1CB4  FE4C        0034     CP 'L'
1CB6  CA801C      0035     JP Z BEGIN
1CB9  FE43        0036       CP 'C'
1CBB  C2911C      0037       JP NZ START  ; NOT A VALID CMND
1CBE  DF          0038      RST GETCHR
1CBF  FDE5        0039     PUSH IY
1CC1  C5          0040      PUSH BC
1CC2  D5          0041      PUSH DE
1CC3  DDE5        0042      PUSH IX
                  0043 ;
1CC5  DD213D1E    0044     LD IX TBL1   ; GET CMND CODES
1CC9  FD21441E    0045     LD IY TBL2   ; GET CMND JUMPS
1CCD  0607        0046     LD B 7
1CCF  110300      0047     LD DE INCR
1CD2  DDBE00      0048 CMD CP (IX+0)    ; DECODE THE COMMAND
1CD5  2003        0049     JR NZ CMD1-$
1CD7  C3E01C      0050    JP GOTIT
1CDA  DD23        0051 CMD1   INC IX
1CDC  FD19        0052     ADD IY DE
1CDE  10F2        0053     DJNZ CMD-$
1CE0  DDE1        0054 GOTIT POP IX
1CE2  D1          0055       POP DE
1CE3  C1          0056       POP BC
1CE4  FDE9        0057       JP (IY)
1CE6  21C41E      0058 DEBUG LD HL MSG1
1CE9  010500      0059       LD BC END1
1CEC  CD3006      0060       CALL PUTMSG
1CEF  C33201      0061       JP 0132H
1CF2  DF          0062 FILE0 RST GETCHR
1CF3  0606        0063       LD B 6
1CF5  DD21631E    0064       LD IX FNAME
1CF9  FE20        0065 FILE1 CP 20H
1CFB  280B        0066       JR Z BLANK-$
1CFD  DD7700      0067       LD (IX) A
1D00  23          0068       INC HL
1D01  7E          0069      LD A (HL)
1D02  DD23        0070     INC IX
1D04  10F3        0071       DJNZ FILE1-$
1D06  1807        0072       JR TYPE-$
1D08  DD7700      0073 BLANK LD (IX) A
1D0B  DD23        0074       INC IX
1D0D  10F9        0075       DJNZ BLANK-$
1D0F  DF          0076 TYPE  RST GETCHR
1D10  32691E      0077       LD (FTYPE) A
1D13  DF          0078      RST GETCHR
1D14  326A1E      0079      LD (DUNIT) A
1D17  D7          0080       RST GETNR
1D18  ED535E1E    0081       LD (DADDR) DE ;LOAD THE ADDRESS OF THE DATA
1D1C  C39A1C      0082       JP INPUT
1D1F  23          0083 CLOSE INC HL
1D20  7E          0084       LD A (HL)
```

```
1D21  FE52      0085        CP 'R'
1D23  2808      0086        JR Z CREATE-$ ; CREATE COMMAND
1D25  3E10      0087        LD A 10H
1D27  CDDC1D    0088        CALL QDOS       ; G DO IT
1D2A  C39A1C    0089        JP INPUT
1D2D  3E0E      0090 CREATE LD A 0EH
1D2F  CDDC1D    0091        CALL QDOS
1D32  C39A1C    0092        JP INPUT
1D35  23        0093 DELETE INC HL
1D36  7E        0094        LD A (HL)
1D37  FE45      0095        CP 'E'          ; MAKE SURE ITS REALLY DELETE
1D39  C29A1C    0096        JP NZ INPUT
1D3C  23        0097        INC HL
1D3D  7E        0098        LD A (HL)
1D3E  FE4C      0099     CP 'L'
1D40  C29A1C    0100        JP NZ INPUT
1D43  3E26      0101        LD A 026H
1D45  CDDC1D    0102        CALL QDOS
1D48  C39A1C    0103        JP INPUT
1D4B  0604      0104 ERASE  LD B 04
1D4D  DD21C91E  0105        LD IX TBL3
1D51  23        0106 RASE1  INC HL
1D52  7E        0107        LD A (HL)  ; IS ERASE SPELLED OUT?
1D53  DDBE00    0108        CP (IX+0)
1D56  C29A1C    0109      JP NZ INPUT
1D59  DD23      0110        INC IX
1D5B  10F4      0111        DJNZ RASE1-$
1D5D  3E12      0112        LD A 12H
1D5F  CDDC1D    0113        CALL QDOS
1D62  C39A1C    0114        JP INPUT
1D65  3E0C      0115 OPEN   LD A 0CH
1D67  CDDC1D    0116        CALL QDOS
1D6A  C39A1C    0117        JP INPUT
1D6D  23        0118 READ     INC HL
1D6E  7E        0119        LD A (HL)
1D6F  FE44      0120        CP 'D'
1D71  280F      0121        JR Z RDN-$   ; READ NEXT N RECORDS
1D73  FE45      0122        CP 'E'
1D75  2813      0123        JR Z REW-$   ; REWIND
1D77  FE43      0124        CP 'C'
1D79  2817      0125        JR Z RCR-$   ; READ CURRENT RECORD
1D7B  FE50      0126        CP 'P'
1D7D  281B      0127        JR Z RPR-$   ; READ PREVIOUS RECORD
1D7F  C39A1C    0128        JP INPUT     ; NOT A VALID READ REQ
1D82  3E18      0129 RDN LD A 18H
1D84  CDDC1D    0130        CALL QDOS
1D87  C39A1C    0131        JP INPUT
1D8A  3E16      0132 REW    LD A 16H
1D8C  CDDC1D    0133        CALL QDOS
1D8F  C39A1C    0134        JP INPUT
1D92  3E1A      0135 RCR    LD A 1AH
1D94  CDDC1D    0136        CALL QDOS
1D97  C39A1C    0137        JP INPUT
                0138 ;
1D9A  3E1C      0139 RPR    LD A 1CH
1D9C  CDDC1D    0140        CALL QDOS
1D9F  C39A1C    0141        JP INPUT
1DA2  23        0142 SKIP   INC HL
                0143 ;
1DA3  7E        0144        LD A (HL)
1DA4  FE46      0145        CP 'F'
1DA6  2807      0146        JR Z FWD-$   ; SKIP FORWARD
1DA8  FE42      0147        CP 'B'
1DAA  280B      0148        JR Z BACK-$ ; SKIP BACK
1DAC  C39A1C    0149        JP INPUT     ; INVALID SKIP REQUEST
1DAF  3E1E      0150 FWD    LD A 1EH
1DB1  CDDC1D    0151        CALL QDOS
1DB4  C39A1C    0152        JP INPUT
                0153 ;
1DB7  3E20      0154 BACK   LD A 20H
1DB9  CDDC1D    0155        CALL QDOS
1DBC  C39A1C    0156        JP INPUT
1DBF  23        0157 WRITE  INC HL
1DC0  7E        0158        LD A (HL)
1DC1  FE4E      0159        CP 'N'
1DC3  2807      0160        JR Z WNEXT-$  ; INSERT N RECORDS
1DC5  FE52      0161        CP 'R'
1DC7  280B      0162        JR Z REPL-$   ; REPLACE CURRENT RECORD
1DC9  C39A1C    0163        JP INPUT    ; INVALID WRITE
1DCC  3E24      0164 WNEXT  LD A 24H
1DCE  CDDC1D    0165        CALL QDOS
1DD1  C39A1C    0166     JP INPUT
1DD4  3E22      0167 REPL   LD A 22H
1DD6  CDDC1D    0168        CALL QDOS
1DD9  C39A1C    0169        JP INPUT
                0170 ;;
                0171 ;THIS IS THE END OF THE COMMAND ROUTINE

                0172 *HEADING <DISC HANDLER FOR ZDOS>
                0173 ;NOTE::::
                0174 ; TO CALL QDOS LD A COMMAND CODE,  LD
1DDC  325C1E    0175 QDOS LD (CMND) A ; # RECORDS
1DDF  D7        0176      RST GETNR
1DE0  7B        0177   LD A E
1DE1  32621E    0178     LD (NRECOR) A
1DE4  215C1E    0179      LD HL CMND
1DE7  CD0013    0180 MDOS CALL ZDOS
1DEA  0602      0181      LD B 02
1DEC  3E00      0182      LD A 0
1DEE  DD217F1E  0183      LD IX MSG4
1DF2  21621E    0184      LD HL NRECOR
1DF5  CD1F1E    0185      CALL HEX
1DF8  21731E    0186      LD HL MSG3
1DFB  010E00    0187       LD BC END3
1DFE  CD3006    0188      CALL PUTMSG  ;OUTPUT # RECORDS
1E01  3A6B1E    0189      LD A (DERROR)
1E04  FE00      0190      CP 0
1E06  C8        0191      RET Z     ; RETURN NO ERROR
1E07  3E00      0192      LD A 0
1E09  DD21891E  0193      LD IX MSG6
1E0D  216B1E    0194      LD HL DERROR
1E10  0602      0195      LD B 02
1E12  CD1F1E    0196      CALL HEX
1E15  21811E    0197      LD HL MSG5
1E18  010A00    0198      LD BC END5
1E1B  CD3006    0199      CALL PUTMSG   ;OUTPUT ERROR CODE
1E1E  C9        0200      RET     ;ERROR RETURN
1E1F  ED6F      0201 HEX  RLD   ;CONVERT HEX TO ASCII
1E21  FE0A      0202      CP 0AH   ;NUMBER<= 9
1E23  380C      0203      JR C NBR-$
1E25  C637      0204      ADD A 037H
1E27  DD7700    0205      LD (IX) A
1E2A  DD23      0206      INC IX
1E2C  3E00      0207      LD A 0
1E2E  10EF      0208      DJNZ HEX-$
1E30  C9        0209      RET
1E31  C630      0210 NBR ADD A 030H
1E33  DD7700    0211     LD (IX) A
1E36  DD23      0212      INC IX
1E38  3E00      0213     LD A 0
1E3A  10E3      0214     DJNZ HEX-$
1E3C  C9        0215     RET
1E3D  4344454F  0216 TBL1 DEFM 'CDEORSW'
1E44  C31F1D    0217 TBL2 JP CLOSE
                0218 INCR EQU $-TBL2
1E47  C3351D    0219    JP DELETE
1E4A  C34B1D    0220    JP ERASE
1E4D  C3651D    0221    JP OPEN
1E50  C36D1D    0222    JP READ
1E53  C3A21D    0223    JP SKIP
1E56  C3BF1D    0224    JP WRITE
1E59  C39A1C    0225    JP INPUT
                0226 *HEADING  ZDOS VECTOR AND TABLES
1E5C            0227 CMND DEFS 1
1E5D  03        0228 DEV DEFB 03H
1E5E            0229 DADDR DEFS 4
1E62            0230 NRECOR DEFS 1
1E63            0231 FNAME DEFS 6
1E69            0232 FTYPE DEFS 1
1E6A            0233 DUNIT DEFS 1
1E6B            0234 DERROR DEFS 8
1E73  23205245  0235 MSG3 DEFM '# RECORDS = '
1E7F            0236 MSG4 DEFS 2
                0237 END3 EQU $-MSG3
1E81  4552524F  0238 MSG5 DEFM 'ERROR # '
1E89            0239 MSG6 DEFS 2
                0240 END5 EQU $-MSG5
                0241 ;
                0242 ;  MESSAGES  ***
                0243 ;
1E8B  4F3D4F53  0244 MSG0 DEFM 'O=OS, D=DEBUG, N=NEW FILE, C=COMMAND,
                0245 END0 EQU $-MSG0
1EC4  44454255  0246 MSG1 DEFM 'DEBUG'
                0247 END1 EQU $-MSG1
1EC9  52415345  0248 TBL3 DEFM 'RASE'
                0249 PUTMSG EQU 0630H
                0250 GET EQU 038H
                0251 GETCHR EQU 018H
                0252 GETNR EQU 010H
                0253 BFR EQU 0C71H
                0254 INPTR EQU 0C53H
                0255 LOAD EQU 0AF3H
                0256 ZDOS EQU 1300H
                0257 OS EQU 0FEH
1ECD  21E21E    0258 HELP LD HL MSG2
1ED0  012200    0259      LD BC END2
1ED3  CD3006    0260      CALL PUTMSG
1ED6  21041F    0261     LD HL MSG7
1ED9  011D00    0262      LD BC END7
1EDC  CD3006    0263      CALL PUTMSG
1EDF  C39A1C    0264     JP INPUT
1EE2  4E20464F  0265 MSG2 DEFM 'N FORMAT >N NAME EXT UNIT BUFADDR '
                0266 END2 EQU $-MSG2
1F04  4320464F  0267 MSG7 DEFM 'C FORMAT >C COMMAND #RECORDS '
                0268 END7 EQU $-MSG7
                0269     END
```

```
BACK   1DB7 0154 0148
BEGIN  1C80 0014 0035
BFR    0C71 0253
BLANK  1D08 0073 0066 0075
CLOSE  1D1F 0083 0217
CMD    1CD2 0048 0053
CMD1   1CDA 0051 0049
CMND   1E5C 0227 0016 0017 0175 0179
CREATE 1D2D 0090 0086
DADDR  1E5E 0229 0081
DEBUG  1CE6 0058 0029
DELETE 1D35 0093 0219
DERROR 1E6B 0234 0189 0194
DEV    1E5D 0228
DUNIT  1E6A 0233 0079
END0   0039 0245 0021
END1   0005 0247 0059
END2   0022 0266 0259
END3   000F 0237 0187
END5   000A 0240 0198
END7   001D 0268 0262
ERASE  1D4B 0104 0220
FILE0  1CF2 0062 0025
FILE1  1CF9 0065 0071
FNAME  1E63 0231 0064
FTYPE  1E69 0232 0077
FWD    1DAF 0150 0146
GET    0038 0250 0023
GETCHR 0018 0251 0038 0062 0076 0078
GETNR  0010 0252 0080 0176
GOTIT  1CE0 0054 0050
HELP   1ECD 0258 0031
HEX    1E1F 0201 0185 0196 0208 0214
INCR   0003 0218 0047
INPTR  0C53 0254
INPUT  1C9A 0023 0082 0089 0092 0096 0100 0103 0109 0114 0117 0128 0131
                0134 0137 0141 0149 0152 0156 0163 0166 0169 0225 0264
LOAD   0AF3 0255 0014
MDOS   1DE7 0180 0018
MSG0   1E8B 0244 0020 0245
MSG1   1EC4 0246 0056 0247
MSG2   1EE2 0265 0258 0266
MSG3   1E73 0235 0186 0237
MSG4   1E7F 0236 0183 0240
MSG5   1E81 0238 0197 0240
MSG6   1E89 0239 0193
MSG7   1F04 0267 0261 0268
NBR    1E31 0210 0203
NRECOR 1E62 0230 0178 0184
OPEN   1D65 0115 0221
OS     00FE 0257 0027
PUTMSG 0630 0249 0022 0060 0188 0199 0260 0263
QDOS   1DDC 0175 0088 0091 0102 0113 0116 0130 0133 0136 0140 0151 0155
                0165 0168
RASE1  1D51 0106 0111
RCR    1D92 0135 0125
RDN    1D82 0129 0121
READ   1D6D 0118 0222
REPL   1DD4 0167 0162
REW    1D8A 0132 0123
RPR    1D9A 0139 0127
SKIP   1DA2 0142 0223
START  1C91 0020 0019 0033 0037
TBL1   1E3D 0216 0044
TBL2   1E44 0217 0045 0218
TBL3   1EC9 0248 0105
TYPE   1D0F 0076 0072
WNEXT  1DCC 0164 0160
WRITE  1DBF 0157 0224
ZDOS   1300 0256 0180
```

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4008	1.20
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4010	.45
4011	.20
4012	.20
4013	.40
4014	1.10
4015	.95
4016	.35
4017	1.10
4018	1.10
4019	.70
4020	.85
4021	1.35
4022	.95
4023	.25
4024	.75
4025	.35
4026	1.95
4027	.50
4028	.95
4030	.35
4033	1.95
4034	2.45
4035	1.25
4040	1.35
4041	.69
4042	.95
4043	1.25
4044	.95
4046	1.50
4049	.80
4050	.60
4066	1.35
4069	.40
4071	.35
4082	.45

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7400	.15
7401	.15
7402	.20
7403	.20
7404	.15
7405	.25
7406	.35
7407	.55
7408	.25
7409	.15
7410	.10
7411	.25
7412	.30
7413	.45
7414	1.10
7416	.25
7417	.40
7420	.15
7426	.30
7427	.45
7430	.15
7432	.30
7437	.35
7438	.35
7440	.25
7441	1.15
7442	.55
7443	.85
7444	.45
7445	.80
7446	.95
7447	.95
7448	.95
7450	.25
7451	.25
7453	.20
7454	.25
7460	.40
7470	.45
7472	.45
7473	.25
7474	.35
7475	.35
7476	.30
7480	.55
7481	.75
7483	.95
7485	.95
7486	.30
7489	1.35
7490	.55
7491	.95
7492	.95
7493	.40
7494	1.25
7495	.60
7496	.80
74100	1.85
74107	.35
74121	.35
74122	.55
74123	.55
74125	.45
74126	.35
74132	1.35
74141	1.00
74150	1.00
74151	.75
74153	.95
74154	1.05
74156	1.15
74157	.65
74161	.85
74163	.95
74164	.60
74165	1.50
74166	1.35
74175	.80
74176	1.25
74180	.85
74181	2.75
74182	.95
74190	1.75
74191	1.35
74192	1.65
74193	.85
74194	1.25
74195	.95
74196	1.25
74197	1.25
74198	2.35
74221	1.00
74367	.85
75108A	.35
75110	.35
75491	.50
75492	.50
74H00	.25
74H01	.25
74H04	.25
74H05	.25
74H08	.35
74H10	.35
74H11	.25
74H15	.30
74H20	.30
74H21	.25
74H22	.40
74H30	.25
74H40	.25
74H50	.25
74H51	.25
74H52	.15
74H53J	.25
74H55	.25
74H72	.55
74H101	.75
74H103	.75
74H106	.95
74L00	.35
74L02	.35
74L03	.30
74L04	.35
74L10	.35
74L20	.35
74L30	.45
74L47	1.95
74L51	.45
74L55	.65
74L72	.45
74L73	.40
74L74	.45
74L75	.55
74L93	.55
74L123	.55
74S00	.55
74S02	.55
74S03	.40
74S04	.35
74S05	.35
74S08	.35
74S10	.35
74S11	.35
74S20	.35
74S40	.25
74S50	.25
74S51	.45
74S64	.25
74S74	.40
74S112	.90
74S114	1.30
74S133	.45
74S140	.75
74S151	.35
74S153	.35
74S157	.80
74S158	.35
74S194	1.05
74S257 (8123)	.25
74LS00	.45
74LS01	.45
74LS02	.45
74LS04	.45
74LS05	.55
74LS08	.45
74LS09	.45
74LS10	.45
74LS11	.45
74LS20	.40
74LS21	.25
74LS22	.25
74LS32	.40
74LS37	.40
74LS40	.55
74LS42	1.75
74LS51	.65
74LS74	.75
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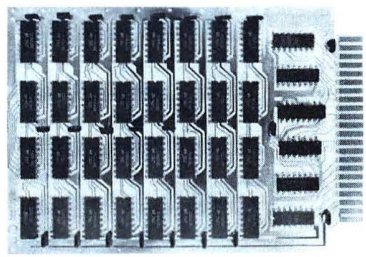

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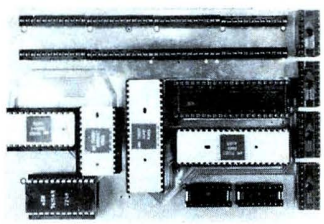

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CIRCLE INQUIRY NO. 95

TO COME IN OCTOBER

The October issue features another big special section on microprocessors in today's scientific and technical world. This time we are featuring the EARTH SCIENCES. Our readers will have an opportunity to enjoy informative articles on meteorology, earthquake prediction, simulations of energy conversion and use, as well as regulation and testing of water resources.

Don't miss this issue. If you have an interesting application in those fields, hasten it to us. The deadline for fixed publication is August 25, but we might be able to accommodate you on a first-come first-serve basis. If you miss inclusion in this Special, we'll assign your article to a later issue.

FIFO FLEA MARKET

FOR SALE: One new assembled Altair 8800B, $725. Call George. Business (213) 684-2401, Home (213) 796-7668.

FOR SALE: CDC/Fabritek 4Kx12 3D core memories, no thermal current regulation required (internal), less supplies, amps, drivers. Have 6 sealed, 1 opened, all working includes connection list, $15 ea. or best offer. IM6100 sampler, assembled & tested, same as Intercept Jr. less edge connectors with DOC (500 pgs). and 24 PDP-8 programs including BASIC, Assm, FTN, ED, ODT, DDT, LOC, SIM, LISP, FOCAL, etc. $160. Talley ptr, less p.s., logic, used less than 25 hours, cost $350, take $125. New Talley ptp, manual, lubs, parts (still sealed), 5-8 lvl, less p.s., cost $395, take $200. Micronta DVM, recenlty calib., Nicads, charger, manual, less than 1 yr. old, $75. Tektronics type 105 sw. wave. gen., like new, $90. All prices negotiable, you ship (C.O.D.). Neil Ferguson, 116 Woodland Circle, Arlington, TX 76013, (817) 265-9054.

FOR SALE: Computer software to print signs. Print long horizontal signs in large block letters. Output letters are 100 print characters high by 50 print lines wide and are printed with characters of that letter. Complete program source text listing and instructions. Program is written in PL/I and is 517 statements long. Send only 517 cents plus 60 cents for mailing. David Sligar, 7091 Pickway Dr., Cincinnati, Ohio 45238.

NEED: Info on general automation SPC 12/12 with 16K core. Any software would be appreciated. Also interested in any other hobbyist with SPC-12 machines, who would be willing to form users' group. Contact Manuel C. Martinez, 7706 W. Gregory St., Chicago, IL 60656, (312) 631-6623.

FOR SALE: SWTPC MP-68 Comptuer system with 12K memory, AC-30 Cassette Interface, CT-1024 Terminal with keyboard in Enclosure Dynamics case, GT-61 Graphics Terminal. All current SWTPC Software plus complete pkg. from TSC. Assembled and running. Original cost was over $1350, will sell for $975. Bob Majdanski, 214 Coolidge Ave., Hasbrouck Heights, NJ 07604, (201) 288-3742 after 7 p.m.

WANTED TO BUY Mini/Microcomputer — CRT — and what have you. Please send list of what you have to: Dr. Joe C. Bryant, 3915 East Independence Blvd., Charlotte, NC 28205.

FOR SALE: Digital Group 8K memory boards. Uses 450 ns low power memory chips. $225. Contact: Roger Schoenmeyer, 7425 Treon Place, Dayton, Ohio 45424. (513) 233-2355.

FOR SALE: Computer Automation LSI 2/20 System with 16K bytes, dual Century floppy discs, CRT and TTY interfaces. Like new, $4000. Call Dick at The Computer Store, (213) 451-0713.

FOR SALE: Teletype Model ASR-33 with MITS. Call-Control Unit Model 88-TYA, stand and one case of roll paper. Brand new—never used. $995 or best offer. Bob Majdanski, 214 Coolidge Ave., Hasbrouck Heights, New Jersey 07604, (201) 288-3742 after 7 p.m.

FOR SALE: Tape reader device. Originally used to read 3 frames of paper tape at a time and convert the data to 15 level paralel output. Housed in a 5 foot rack cabinet with a ¾ door & casters are: 1 ea. Digitronics 2500 300cps 8 level reader & 4566ALCR spooler; 20 clot 36 pin card cage; 12 Navcor logic boards, 1 extender; 1 Navcor ± 12V @ 2A, -100V @ ¼A power supply, metered; 1 chassis with relays, etc. Orig. cost $9,500; NOW $600 (you pick up or freight; 200 lbs.) Mike Gerow, 244 W. 1st Ave., Roselle, NJ 07203. (201) 241-3200; (201) 334-7246 nights.

FOR SALE: Okidata CP-110 printer, loaded with options such as RS-232 (110 to 9600), upper/lower case char-set, tractor feed, bi-directional printing, top-of-form option, & on-board self-test electronics. Only used twice, still in original factory carton. new costs over $1,900; must sacrifice for $1600. & you pay shipping. Contact: Don Cheeseman, P.O. Box 5534, San Antonio, TX 78201, or call (512) 699-6880.

FOR SALE: iCOM Microfloppy with 1 drive, interface board and FDOS -plus-basic (also assemblers and editors on disk) ALL ASSEMBLED (factory) AND TESTED. ONLY $800.00 (or best offer). Retails for $1095.00. Write: E. Lipps, 205 Chautauqua, Pacific Palisades, CA 90272 Or call: (213) 454-7690 (after 4 p.m.) ask for Eliot.

FOR SALE: Imsai PI04-4 Par. and SI02-2 ser. interface boards. $155 each. Cables also available. Various 4K RAM boards. $125 each. All assembled and tested. Byte #1 thru 4, $10. Trade any boards toward floppy disc? Dieter Kaetel, 7201-87 S.E., Mercer Island, WA 98040. (206) 232-1513.

FOR SALE: Altair 8800, 4K Static, 4K Dynamic, Serial I/O (RS232 Compatible), Tarbell Cassette Interface, Complete Documentation. New, cost $1576. Barely used & totally functional: $1375 or best offer. Norm, (213) 341-1275, 8505 Lurline Ave., Canoga Park, CA 91306.

FOR SALE: PERTEC 7850 9Tr magtape Drives w/elec, $275 w/man; ± 12/3A & ± 5/5A supplies, $25; Superior Elec TRP125 120Byt/S opt readr, $200; IVC 600 Color Video recorders w/man. $300 (orig. $2700) w/tape; MSI FD8 disc case & pwr sply $85. Gary Gaugler, 2276 Beaver Valley Rd., Fairborn, OH 45324, (513) 878-0288.

FOR SALE: IMSAI 8080 with 22 slot mother board $649., PolyMorphic video board VTI-64 $199., Vector graphic 8K memory board $235., Solid State Music 8K memory board $225., Radio Shack keyboard with custom case $49., and a Tarbell cassette interface $109. Assembled, tested, in excellent condition. Call (714) 870-1387 or write to B. Marr, 1800 Brea Blvd., Box 18, Fullerton, California 92635.

WANTED: Mini-Processor Computer like SOL 20 or IMSAI 8080 with 24K memory. Peripherals such as printer, CRT or adapted TV, Floppy Disk System, Alpha-Numeric Keyboard or other components that can be used with record keeping and teaching in Youth Oriented Ministry of Small Church. Would appreciate this as a donation. Will give a tax deductible receipt in letter form. You determine the value for tax purposes. Write Rev. Jack Weaver, Pastor; Palmetto Bible Chapel, 16255 S.E. 82 Avenue, Perrine, Florida 33157 or call (305) 238-4837.

FOR SALE: 4 Solid State Music 4K RAM boards, wired and tested. 90.00 each. P. Sargent, 4209 Knoxville, Lakewood, CA 90713. (213) 421-9521.

FOR SALE: HP9815A programmable calculator w/extended memory, carry case, 4 cartridges, thermal paper, manuals; exc. cond. Over $3600 new, asking $2600. Walt Goldys, 200 S. Glenn Dr., #53G, Camarillo, CA 93010. (805) 482-4674.

FOR SALE: SWTPC CT-1024 terminal with keyboard, power supply, computer cursor control, and RS232 I/O board PLUS Case (aluminum). All assembled and tested. For: $195.00. Write: E. V. Lipps, 205 Chautauqua, Pacific Palisades, CA 90272 or phone (213) 454-7690 (after 4 PM).

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Since we have recently changed computing services, please note the address change on the reader service card to: INTERFACE AGE Magazine, Box 2654, Clinton, Iowa 52732.

ARTICLES

392 General Ledger Package
by Bud Shamburger

393 Microcomputers: The Intelligent Terminals
by Jeb and Elizabeth Long

394 Star-Ship Simulation — Part II
by Roger C. Garrett

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JUNE WINNER: General Payroll Package by Bud Shamburger

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C ☐ Club Meetings
D ☐ Direct Mail From Manufacturers
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7. I prefer To Buy
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Powerful in computing muscle, yet small in physical size, the Altair™680b offers many special features at an affordable price. Based on the 6800 microprocessor, the 680b comes with 1K of static RAM, Serial I/O port, PROM monitor and provisions for 1K of PROM as standard components. It's good thinking, when you're interested in making a modest investment on a highly reliable computer, to consider the Altair 680b.

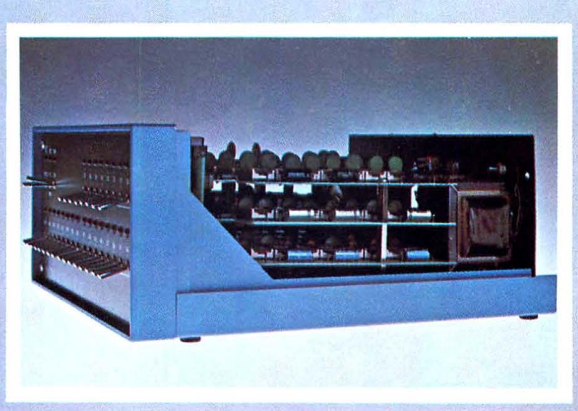
Our PROM monitor eliminates the necessity for toggling front panel switches to load bootstraps or manipulate memory contents. Only a terminal and programming language are required for complete system operation. With Altair System software—Altair 680 BASIC, assembler and text editor—you may begin problem solving immediately with ease.

By adding the 680b-MB Expander card, many options are currently available:

*16K Static Memory Board—Increase your system memory with 16K bytes of fast access (215 ns), low power (5 watts per board) static RAM. 680 BASIC and assembler/text editor are included free with purchase.

*Process Control Interface—A PC card that uses optically isolated inputs and relay outputs that transmit sensory information to and control signals from the computer. A diverse world of control applications is opened up with the Altair 680b-PCI.

*Universal Input/Output Board—If your I/O needs exceed the serial port already on the main board, augment your I/O channels with the 680b-UI/O. By implementing the optional serial port and two parallel ports, you can simultaneously interface to four terminals.



*New Addition—Kansas City Audio Cassette Interface—Use the 680b-KCACR to interface your Altair 680b with an audio cassette recorder for inexpensive mass storage of programming languages, programs and data.

Available in either full front panel or turnkey models, the Altair 680b presents many computing capabilities at a low cost—without skimping on performance. See it today at your local Altair Computer Center or contact the factory for further details.

mits

Good Thinking.

2450 Alamo S.E. Albuquerque, New Mexico 87106
dealer inquiries invited.

CIRCLE INQUIRY NO. 31

UP AND RUNNING

TDL EQUIPMENT USED BY NEW JERSEY PUBLIC TELEVISION
TO PROCESS NEW JERSEY GUBERNATORIAL PRIMARY ELECTION RETURNS

John Montagna, computer engineer (above left), lead this successful network team in generating election results speedily, efficiently and reliably using predominantly TDL hardware and software. Montagna created three programs to get the job done. The text for a SWAPPER program was written and assembled using the TDL TEXT EDITOR and Z80 RELOCATING MACRO ASSEMBLER. The SWAPPER text and all debugging was run through TDL's ZAPPLE MONITOR. The relocatable object code was punched onto paper tape. A MAIN USERS program updated votes and controlled air display. An ALTERNATE USERS program got hard copy out and votes in. The latter two programs were written in BASIC. Montagna modified the ZAPPLE BASIC to permit time-sharing between the two USERS programs.

Four screens were incorporated, two terminals entered votes as they came in and were used to call back votes to check accuracy. Montagna called on the power and flexibility offered by TDL's ZPU board and three Z-16 Memory boards.

Montagna's setup worked constantly for over four hours updating and displaying state-wide and county-wide results without flaw.

"I chose TDL because they have all the software to support their hardware, and it's good; it has the flexibility to do the job."
John Montagna

We salute John Montagna and NEW JERSEY PUBLIC BROADCASTING for spearheading the micro-computer revolution.

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CIRCLE INQUIRY NO. 51